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THE PROFESSIONS IN THE SOCIETY OF TODAY*

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IN THE good old pioneer days in one of the younger western commonwealths a man conceived the idea that by putting a magnet in a box of ointment and leaving it there overnight he could produce a "magnetic ointment" with marvelous powers. He impressed a community with the value of his magnetic ointment and soon did a considerable business in making and selling it. On this he built up an extensive practice in the way of consultations with the ailing and prescribing different methods of using and applying the ointment according to the nature of the difficulty. Then came a statute requiring those who practiced medicine to take an examination and procure a license, and the old man, having neglected these formalities, was prosecuted and convicted of practicing medicine without a license. In passing sentence the trial judge spoke severely about amateur prescribing of quack remedies as a menace to the general health. At this the old man broke in protestingly. He said: "Your Honor is calling me an amateur? Why, I have made more money in my business each of the last five years than all of any three licensed doctors in the county put together."

Undoubtedly the professional athlete, whose type is perhaps the professional baseball player, has confused popular ideas in this connection. The distinction between the professional and the amateur, of which we hear so much in the absorbing interest of sport, has done much to make a profession denote a money-making activity. In fifty years of teaching of law to students in the face of modes of thought engendered by sport, I have not found it easy to impart the conception of a group of men pursuing a common calling as a learned art and as a public service — nonetheless a public service because it may incidentally be a means of livelihood. From the Middle Ages, the formative era of our social institutions, we had received this idea of a profession, and medicine, the law, the ministry and teaching had grown up to its pattern. The conservatism of the universities and of professional schools on their model, and the inherited spirit of the apprentice training, which for a time succeeded academic teaching of medicine and law in England and America, transmitted this idea to our time, and our books are full of it. But the idea was sorely tried under the reign of pioneer modes of thinking in nineteenth-century America. Moreover, many important callings have been claiming to rank with the older recognized professions as learned arts, taught in universities and pursued in a tradition of learning. Such are at least journalism, engineering, business administration, social work and public administration. In addition, almost all callings and activities have become organized and are pushing for every kind of recognition. Thus, we must inquire how far our older idea of a profession may be stretched to include socially or economically important callings of today and how that idea, stretched or not, is affected by the rise of the service state and its consequences in the society of the time.

Let me repeat what we mean by the term profession when we speak of the old recognized professions. We mean an organized calling in which men pursue a learned art and are united in the pursuit of it as a public service — as I have said, no less a public service because they may make a livelihood thereby. Here, from the professional standpoint there are three essential ideas — organization, learning and a spirit of public service. The gaining of a livelihood is not a professional consideration. Indeed, the professional spirit, the spirit of a public service, constantly curbs the urge of that instinct.

It is no disparagement of honorable trades and callings, which when properly carried on render real public service, to insist that an organized profession of physicians or of lawyers is not primarily analogous to a retail grocers' association and that there is a generic distinction between a medical society or an organized bar and a plumbers' or lumber dealers' association. It is unhappily true that there was in the last century in America a tendency to deprofessionalize the old professions, to reduce all callings to the level of individual business enterprise, and to think of medical societies or bar associations as like trade organizations. But the root purpose is different. The trade association exists for the purposes of the trade as a money-making

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activity. The medical society exists primarily for the purposes of medicine, not of the doctor of medicine, and for the advancement of the healing art. The bar association exists primarily for the purposes of the law rather than of the lawyer and for advancement of the administration of justice according to law. Lord Darling spoke of certain legislation enacted at the instance of trade organizations as intended to relieve the members of those organizations from the humiliating position of being on an equality with the rest of the King's subjects. An organized profession, on the other hand, seeks no such legislation relieving it of duties incumbent upon it. It does not seek to advance the money-making feature of professional activity but seeks rather to make as effective as possible its primary character of a public service. What medical associations have done for advancement of medicine I need not recount to you. But I may remind you that bar associations have in the present generation lifted the standard of professional education, codified professional ethics, promoted uniformity of commercial law, and brought about simplification of legal procedure and removal of archaic technicalities. An engineer may patent his invention. A manufacturer may protect his trade secret or patent his discovered process. What a member of a profession invents or discovers is not his property. It is at the service of the public.

A tradition of duty of the physician to the patient, to the medical profession, and to the public, a tradition of the duty of the lawyer to the client, to the profession, to the court, and to the public, authoritatively declared in codes of professional ethics, taught by precept and example and made effective by the discipline of an organized profession, makes for effective service to the public such as could not be had from individual practitioners not bred to the tradition and motivated, as in a trade, primarily, if not solely, by quest of pecuniary gain. Nor can this professional tradition be replaced with benefit to the public by a political tradition of officeholders owing primary allegiance to political parties and depending for advancement on the favor of political leaders. Moreover, the professional organization and tradition are even more to the public interest in their effect on the learned arts that the professions follow as callings.

All advance in science, in arts, in learning, in short, all progress in civilization — in the raising of human powers to their highest possibilities — is the result of trial and error, that is, of experimentation. Every physician, every hospital, every lawyer, every law school, every teacher can and is impelled to experiment and invent, and as the professional spirit of public service leads to promulgation of the results of experiment and invention and putting the results freely at the service of others, they are not individual trade secrets and are not patented; they do not need to be argued to bureaus, nor do those who would use them have to await official adoption of them. They are open to free use and make their way on their intrinsic merit.

Huge bureaus of graduates of medical schools and of law schools, brought up to seek public office and organized in the civil service as public employees, can be no effective substitute for the professions.

Unhappily, the public interest in having a body of practitioners of medicine and of law imbued with the spirit of a profession and by training and organization and discipline held to high standards of professional conduct was not so clear in pioneer America as it is today. The idea of a profession seemed repugnant to rising American democracy. The feeling was strong that all callings should be on the same footing, namely, the footing of a business — of a money-making calling. To dignify any calling by holding it a profession, and to prescribe high qualifications for and limit access to it, seemed undemocratic and un-American. Moreover, pioneer America distrusted specialists. Faith in versatility was pre-eminently an article in the pioneer's creed. In consequence, there was a general rejection of the idea of a learned, responsible, self-governing profession. You know what the situation was in medicine when in 1910 the American Medical Association with the help of the Carnegie Foundation took medical education in hand. Let me tell the story of the law to make the point further. Some states threw the practice of law open to nonlawyers, with bad effects on legal procedure some of which are still manifest, and, indeed the legal osteopath and legal chiropractor and legal faith healer have been as favored by American legislators as have their medical counterparts. Some states that retained a requirement of admission to the bar provided that anyone was to be admitted with no other qualification than lack of a conspicuously bad character. All the states, by legislation or by increasingly lax administration of their requirements and lack of public or professional interest in the matter, made entrance upon practice easy with a minimum of qualification. As population increased, and large numbers of lawyers were admitted in great urban centers, discipline became lax, and many forensic abuses, such as offensive conduct toward witnesses and abuses in the fomenting of litigation, grew up. As the practice of law was regarded as only a business, organizations grew up in large cities in which lawyers, physicians, runners and even professional witnesses came to be engaged in preying alike upon the victims of accidents and those responsible for accidents. Experience taught us the value of the professional tradition and of the distinction between a profession and a trade. Reprofessionalization has gone forward steadily for two generations.

But reprofessionalization had hardly been achieved when the idea of a profession began to be subjected to new pressure.

From the beginning, American political thought had been dominated by fear of governmental oppression of the individual. Those who colonized America had been brought up in an atmosphere of resistance to the centralized personal government of the Tudors and Stuarts, and experience of arbitrary government of the colonies from Westminster had strengthened their feeling. Coincident with the movement for reprofessionalizing the old professional callings, however, there has been a change in the American attitude toward government. In a recent book Professor Corwin has written of the decadence of the fear of governmental oppression. Throughout the world the present century has seen a steady rise of the idea of the service state — the state that performs all manner of services for the people instead of leaving them as free as possible to serve themselves or to procure services for themselves according to their individual ideas of what they need or what they wish. I am not here to speak against the service state. In an age of bigness other interests than the social interest in the general security press for recognition, and the state that merely keeps the peace and maintains order does not satisfy. But with the multiplication of services rendered by the state comes a multiplication of officials, and ideas of official omnicompetence and majority infallibility come also. When every form of public service becomes at least potentially a state function, the difference between a public service performed by a profession and a public function performed by a bureau becomes crucial. The one becomes a matter of free enterprise, and the other one of politically regimented activity.

Accordingly, I seem to see four sources of menace to the professional ideal in the society of today. One, the exigencies of the individual economic existence, has always been with us. It is simply magnified in the crowded world of the time. A second is the multiplication of detail in every branch of learning, and notably in the learned arts pursued by the members of a profession. Nowadays these details are multiplied beyond what the individual practitioner can hope to master completely. There is consequent need of co-operation of practitioners leading to partnerships of increasing size and conceivably even to corporations in which individual responsibility may become merged. Thirdly, when this stage has been reached it is difficult to resist the pressure of business methods, which easily become the methods of competitive acquisitive activity. Fourthly, all this goes along with and is given impetus by the advent of the service state and consequent growing tendency to rely on official rather than on individual private initiative and to commit all things to bureaus of politically organized society.

Let me illustrate from the legal profession, what you can no doubt duplicate from your profession, the difference between the last century and the present.

In November, 1890, two farmers in the county where I had been admitted to the bar, being advised each by his lawyer that a doubtful point of law was decisive of their dispute and that if litigated it would have to be taken to the Supreme Court for final determination, agreed to submit the question of law to the opinion of a well known lawyer in the capital of the state from which they both had come. Accordingly an agreed statement of the facts, which were not controverted, was drawn up, and I was sent with it by agreement of the parties to obtain the desired opinion. The lawyer whose opinion I was to get was one of the leaders of the bar in not the least of the states of the Middle West. His office, around the corner from a main street of the capital city, was a one-story brick building from which there hung over the sidewalk a small, weather beaten sign, "Notary Public." Going in at the front door I found a room furnished with the wooden cuspidors of the period and old-fashioned chairs such as we used to see on the sidewalks in front of country hotels, and with the walls lined with bookcases extending to the ceiling and full of books. There was a long table in the middle of the room with law books and a Webster's Dictionary on it. In one corner there was a combination desk and bookcase at which sat one whom I took to be a clerk. In another corner one whom I took to be a student "reading law," as the phrase then was, had a book open before him. Having stated my business to the clerk, I was soon admitted to the inner office, which was furnished much as the outer room. The lawyer presently looked up from some papers he was reading and said he was at my service. I handed him the agreed statement of facts and explained that his written opinion on their legal effect was desired. He asked if there was any statute on the subject in the state from which I had come to him. I told him there was not, nor had the question of law been passed on by the Supreme Court of that state. It was a question of common law, and hence his written opinion was desired. He looked over the statement of facts once more, tapped the table with his fist a few times, pulled a few sheets of legal cap paper out of a drawer and then and there wrote out by hand a three-page opinion in ink, which he handed me. I had come prepared to pay a fairly large fee, but he had endorsed a relatively small one on the opinion and when I paid it he receipted it in the same place. Such was the office of a leader of the bar in the consulship of Plancus.

A few years ago a lawyer from a rural county seat in Maine had occasion to call upon one of the leaders of the bar in Boston. Going up in the elevator in a large office building he found the leader's firm occupying two floors. There was a great room like a court, where he went in. Around it were

office rooms on all sides and above were more rooms all around on a balcony. In the middle of the court-like space was a desk in charge of a "receptionist." Typewriters were clicking all about, many people were seated about the room, and many were hurrying in and out of the office rooms. The astonished country lawyer went up to the receptionist and said: "I want a room with bath."

It is not easy to maintain the professional ideal in such an atmosphere of a great law factory. What keeps it alive is the professional tradition. But one may question whether it could be kept alive if for the metropolitan law office we were to substitute a huge government bureau. Certainly the ideal is strained in the legal departments of some great public utilities with their staffs of lawyers, law clerks, investigators and experts. Some great industrial enterprises have such legal departments also. Whether medical departments approaching this have been growing up I do not know. At any rate, the tendency of our economic development, as it affects the legal profession, is to bring about something very like a class of employees of corporations called law clerks who may yet be seen forming a law clerk's union affiliated with the CIO, and exerting themselves not to advance the administration of justice but to advance the compensation of law clerks. An incidental bad effect of this course of development of the metropolitan lawyer is that the bar often comes to be divided into two classes, habitual plaintiff's lawyers and habitual defendant's lawyers, each with its staff of lawyers, law clerks, experts and, one suspects, witnesses. Already we have great administrative bureaus of the national government and of state governments, each often with its legal and medical and technical staff.

Economic expansion, the growth of industry, the multiplying of metropolitan cities and the new relations calling for adjustment and new problems of ordering the conduct of enterprises and the relations involved in them have called for the type of office I have described. It is a natural and inevitable response to them. But even more the professional ideal is menaced by the development of great government bureaus and a movement to take over the arts practiced by the professions and make of them functions of the government to be exercised by its bureaus in a superservice state that may become a service super-state. For the idea of a profession is incompatible with performance of its functions or the exercise of its art, by or under the immediate supervision of a government bureau. A profession postulates individuals free to pursue a learned art so as to make for the highest development of human powers. The individual servant of a government exercising under its supervision a calling managed by a government bureau can be no substitute for the scientist, the philosopher, the teacher, each freely exploring his chosen field of learning and exercising his inventive faculties and trained imagination in his own way, not as a subordinate in a bureaucratic hierarchy, not as a hired seeker for what he is told to find by his superiors, but as a free seeker for the truth for its own sake, impelled by the spirit of public service inculcated in his profession.

If all callings are but money-making activities and making of a livelihood is their primary concern, it follows, in an economic order in which the great majority of the community are on the payroll either of the government or of some corporation, public, public service, charitable, or private, that most of us are in a sense employees and so liable to be caught up in a regime of employees' organizations, collective bargaining over wages and strikes. Organization of physicians for advancement of medicine, organization of lawyers for advancement of the administration of justice and organization of teachers for the advancement of teaching must give way to organization of employees of every grade and kind of employer for the advancement of wages and dictation of the conditions of employment. Already the two major labor organizations are carrying on a campaign to unionize the "white-collar workers" in industry and business. This may well presently take in the younger members of the bar in the legal departments of large companies. Already the American Federation of Labor has organized municipal employees, and in Los Angeles the probation officers, whom we had been thinking of as members of a rising profession of social workers, are members of the Probation Officers' Union, a branch of the Municipal Employees' Union, affiliated with the national organization. The National Labor Relations Board held and was upheld by the Supreme Court of the United States in holding that plant guards during the war, enlisted at first as soldiers and later made part of city police forces, could be organized in unions by the Congress of Industrial Organizations. Are the young lawyers in the office of a city attorney, along with the clerks and stenographers, the municipal probation officers, the clerks, secretaries and typists in the various city departments, the firemen and the policemen, to be in a union of municipal employees and from time to time to strike for increased pay as collective bargain contracts expire or when one of their number is removed or discharged? Next, county employees may be organized as such so that the clerical force in the courthouse may go on a strike and tie up the administration of justice. Are the assistant district attorneys to be unionized also? May we not see unions of state employees and find the secretaries of the judges of the Supreme Court striking? Already there are unions of federal employees, and these may come to include the young men, members of the bar, who are secretaries to the justices of the highest court in the land. Every department and major ad-

ministrative agency of the federal Government has many lawyers on its roster. Unions of federal employees will seek to include them. Moreover, the law reports show that the courts have come to be much troubled to determine whether and when physicians in a hospital are independent contractors and when they are employees of a charitable corporation.

Teachers in the public schools have been unionized in more places than one, and members of university faculties are now active in a teachers' union in some of our old historic institutions. Are we to see closed shops of higher learning, with union faculties collectively bargained with, check off for union dues and all the concomitants of organized pursuit of higher wages in what had been thought a learned profession?

Thus, as things are coming to be in an era of bigness, large-scale organization of all activities and strenuous acquisitive competitive self assertion, the professional idea must contend with the rise to power of organizers of an expanding class of employees. Thus more and more, as things are, as individuals in the professions have come to be regularly retained or nowadays regularly employed by great corporations or appointed to substantially permanent positions under the federal Government or state and municipal governments and administrative agencies, a constantly larger number of practitioners in their capacity of employees are enlisted in organizations with the trade spirit of emphasis on wages rather than the professional idea of pursuit of a calling in the spirit of public service. Unless we are vigilant it may well be that this prevailing of the trade idea will make straight the path toward absorption of the professions in the service state. The course of that path is not hard to plot. We can see three possible stages: unionizing of all callings that may be taken to involve employment, at least so far as some in the calling are not capable of classification as employers; assumption of control of professional education by government subsidies and thus subordination of the professions to bureaucratic management; attempts to bring cheap and equal professional assistance to everyone's back door by government taking over of the callings pursuing learned arts. Such a consummation may be pictured as a carrying of the idea of the service state to its furthest logical development. The service state began by performing a few major services. In time it has undertaken more and more. Now it seems jealous of public service performed by anyone else. The advocates of the omnicompetent state will say that in primitive or pioneer societies certain public services are rendered by anyone who seeks to try his hand on the basis of such qualifications as he deems sufficient. Later, as society advances such services are rendered by well qualified practitioners organized in professions, the qualifications, as these professions develop, being prescribed and ascertained by governmental authority. Ultimately, it will be said, as political organization of society reaches maturity, all public services of every sort are to be exclusive governmental functions to be exercised by government bureaus.

Very likely, not all those who are teaching or preaching the doctrine of the super-service state will, at the moment, admit this conclusion. But I submit that before we go far with them on the path in which they are marching we should pause to see whither it leads. It should be remembered that the rise of the totalitarian state was coincident with the general reception of the idea of the service state and that both have Marxian socialism in their pedigree. Each in its way postulates an omnicompetent administration by supermen. If experience may be vouched, that means in the end supermen under the direction of an *ex-officio* superman.

But leaving aside the question of the effect upon our American constitutional democratic polity of carrying the idea of the service state to its furthest development, let us look more in detail at the effect of that idea, as it is being urged, upon the professions.

Practice of medicine and practice of law, the ministry and teaching are each of them essentially an individual learned art. Each is an art in which the individual approach of a skilled practitioner to the task immediately in hand is of first importance. He cannot be made to a model so that everyone can have the benefit of a professional man exactly as good for every purpose as everyone else has. The required combination of training, native skill and experience makes each practitioner in some measure and in varying degrees unique. No bureau and no super-administrator at a center of government, especially in a country of continental extent like our own, can co-ordinate all medical treatment, all medical research, all advocacy, all juristic inventiveness, all spiritual help or preaching, or all teaching, so that every locality and every citizen shall have the same advantages as every other. The professional ideal, however, promotes effective individual treatment, individual counsel and forensic exertion, individual ministry and individual teaching, to the best of the powers of the individual practitioner, minister or teacher. Such things do not lend themselves to paper reports and mechanically produced uniformity and equality. The attempt to produce them may reduce the performance of the highest skills to a lower level of performance without raising the quality of lower skills or lesser experience. Uniform governmental management would sacrifice the reality of the public service sought to the exigencies of statistical and bureau-chart methods.

Government-managed religion was given up centuries ago. But centralized government manage-

ment of medicine, advocacy and teaching are becoming live issues, and, as you know, the threat to medicine as a profession is especially acute. The same objection to government-managed religious worship — namely, that it eliminated the spirit that gives life — applies, as has been said, in the other professions, no less than in the ministry. Their whole purpose is defeated if practice of them falls into a mechanical routine. Moreover, in the democratic polity of today, government-managed medicine, government-managed advocacy or government-managed teaching means putting these fundamental social needs into politics, and not the least bad effect of putting them in politics is that it becomes no longer possible for the people to get nonpolitical expert advice, such as at times they need sorely. This is true not only of government-managed professions but also quite as much of government-subsidized institutions.

Under a system by which local funds for research or for teaching are derived from the national capital even the small part allocated to a locality imposes a kind of censorship on the local authorities. In their eagerness to share in the governmental distribution local officials are loth to make statements or espouse ideas out of conformity with the political or economic doctrines or aims of the central administration or in conflict with the scientific doctrines that its bureaus advocate. Government propaganda goes on upon a large and increasing scale, and dissent is silenced. The effect of this upon a learned art pursued in the spirit of a public service cannot fail to be destructive. How can scientists disagree with the government-promoted doctrines, how can advocates stand up against arbitrary bureaucratic administrative action, how can teachers teach the truth against officially approved doctrines when disagreement means failure to get government grants for research or government subsidies for the institution in which one is employed, or government appointments or assignments to salaried positions?

Aristotle thought that if the individual was not allowed to choose his physician but must go to the one assigned to him by the magistrate under a law, it would be necessary to have the law fix the definitely prescribed prescription for every specific ill. This would carry mechanical therapy to the extreme. But he did not join to it bureau-dictated research and investigation.

Understand me. I am not preaching against the service state in itself. The society of today demands services beyond those which the state that only maintained order and repaired injuries could perform. Administrative agencies of promoting the general welfare have become a necessity and are with us to stay. It would be futile to quarrel with the idea of a service state kept in balance with the idea of individual spontaneous initiative characteristic of the American. What one must resist is not state performance of many public services but the idea that all services must and can only be performed by the government. The need is to maintain a balance between individual initiative and regimented co-operation. What I deprecate is the carrying of the idea of regimented co-operation to the extreme: the exaltation of politically organized society to the position of an absolute ruler. It is not easy for mankind to keep in mind at the same time two ideas that logically negate each other if each is carried to the extreme of its logical possibilities. But this must often be done. To take but one example from our criminal law, we have to keep in mind continually both the idea of justice, the ideal relation among men, and the idea of security. The idea of security calls for a maximum efficiency of criminal investigation and detection. Carried to its farthest it could, at least in extreme cases, be made to justify the third degree — the extortion of confessions by brutal treatment of suspected offenders. On the other hand, such methods are repugnant to the idea of justice and to another idea we must not lose sight of in the law — namely, the ideal of morals, the idea of ideal development of individual character, to which the third degree and like methods of criminal investigation are no less repugnant. When we think only in terms of the general security we make no objection to extorting confessions, to holding incommunicado, to searches of homes and seizures of papers and to wire tapping. When we think only in terms of justice or of morals we go to the extreme of hampering criminal investigation by rigid provisions in bills of rights such as were at times, at least in their application, carried beyond reasonable limits in nineteenth-century America. We have not yet succeeded in adjusting satisfactorily the conflicting requirements of these ideas.

I have often compared this problem of politics and law to the task of the juggler in the circus who keeps a succession of glass balls in the air at once, back and forth from his hand, never losing sight of any nor giving any one too exclusive attention. We have such a problem in the rise of the service state. Its requirements and its logical limits are not the whole of the science of politics any more than the requirements and logical limits of the general security are the whole of the science of criminology.

Casting off of the past is not the whole of progress. Institutional waste, the needless destruction of the old in introducing the new, has always to be guarded against. It would be nothing less than institutional waste to throw away the idea of a profession in order to develop services to be performed by government that politically organized society in the last century made no attempt to provide. A reasonable development of the service state does not require such things as the teachers' strikes we are beginning to see, much less the physicians' or

surgeons' strikes, or lawyers' strikes, or ministers' strikes, which are foreshadowed by the impairment of the professional idea and the dominance of the idea of all callings as mere means of gaining a livelihood. Even less does the rise of the service state require to lead to setting up of the totalitarian state. Here, too, a balance is required, however easy it may be to go, as man is so likely to go, from one extreme to the other and then back again.

After all the individual man is the moral, social and legal unit. Certain of his activities may be organized in groups and associations and political societies. But his personality is not merged in any of them. Recognition of the moral worth of the individual human being is the great achievement of the political and juristic philosophy of the eighteenth and nineteenth centuries. Appreciation of the social interest in the individual life is the significant achievement of the social philosophy of the present generation. It is not likely that any political or economic order that may supervene in such time as we can foresee will succeed in putting down the individual self-assertion that has been a motive force of progress. But the attempt to put it down with a sole eye to regimented co-operation may do a great deal of harm.

There has always been a human tendency to worship rulers. Today, majority dictation is often reverenced as the monarch's arbitrary dictation was in the seventeenth century. Lord Acton tells us that all power corrupts; absolute power corrupts absolutely. Majority-dictated science, majority-dictated philosophy and majority-dictated teaching take us back to the absolute rulers whom we set up majority rule to overthrow. The service state is a political step forward. But we must not let it turn back upon itself and lead us to absolutism. There is no surer route to absolutism than an unchecked omnicompetent bureaucracy.

PSEUDOMYXOMA PERITONEI ASSOCIATED WITH CHOLESTEROSIS*

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WERTH,[1] in 1884, first called attention to the unusual finding of a gelatinous exudate, partly free and partly encysted, in the peritoneal cavity of a woman bearing a "pseudomucinous cyst" of the ovary. He named the process "pseudomyxoma peritonei" and traced its origin to the rupture of the ovarian cyst and subsequent implant of the cystic contents on the peritoneal membranes. In 1901 Fraenkel[2] found a similar condition in a man with a ruptured mucocele of the appendix. Because of the gross similarity of patterns he considered it appropriate to retain the denomination previously proposed by Werth.[1]

Since then quite an extensive literature has accumulated concerning this comparatively infrequent process. It is now well established that "pseudomyxoma peritonei" is not a disease in itself but an unpredictable complication occurring in the course of a variety of intra-abdominal conditions, including ovarian cyst-adenoma, mucocele of the appendix, omphalomesenteric cyst, intestinal diverticulum and retroperitoneal cystadenoma. Most unusual in this respect is the case described by McCrae and Coplin,[3] in which the condition developed as a sequel to a gall-bladder carcinoma.

For a clear understanding of the process two main problems must be considered.

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The first concerns the retention of the mucinoid material in the secreting viscus.

Obstruction of the appendiceal lumen and inability of the appendix to empty itself have been considered responsible for the mucocele of the appendix.[2] As the glands in the appendix continue to secrete, the organ gradually becomes distended with mucus. The resulting increase in internal pressure leads to thinning and eventually to rupture of the walls of the appendix, with resulting extrusion of the mucous content into the peritoneal cavity. The experimental work of Grodinsky and Rubnitz[4] and of Rubnitz and Hermann[5] has contributed considerable information explaining this sequence of events. This applies also to the "pseudomyxoma peritonei" resulting from the obstruction and rupture of an intestinal diverticulum.[6]

As for the "pseudomyxoma peritonei" of neoplastic origin the accumulation of secretion within the tumor mass is self-explained by the intrinsic nature of the process.

More difficult to understand is the second problem, the one concerning the continuation of secretion of the matter, whatsoever its source, escaped within the abdominal cavity. Many theories have been advanced to explain this point, but the one still most favorably accepted is Fraenkel's[2] original view of a seeding of the peritoneal membranes with secreting cells, subsequent cellular proliferation and mucous secretion.

The further course of the process depends upon the intrinsic nature and the potentialities of growth of the seeded cells. Cases have been reported in which the process spontaneously regressed through slow reabsorption of the extravasated material. In other cases a peritoneal reaction was found set up around the transplanted mucus and the quiescent epithelial cells, as an attempt, on the part of the organism, to wall off or to engulf the foreign material. Under the same indefinite heading of "pseudomyxoma peritonei" other cases are encountered of true infiltrating cancerous growths, with active proliferation and further dissemination of secreting epithelial cells implanting themselves in the peritoneal surfaces and invading the lymph channels.[7, 8]

The precancerous nature of the mucous membrane of the appendiceal mucocele has been emphasized by Waugh and Findley[9]; Hentz[10] and Oberndorfer[11] have pointed out that a cancerous degeneration may take place in the secretory epithelial cells, poured into the abdominal cavity. According to Woodruff and McDonald[12] there are two kinds of mucocele: one, which is underlined by cancerous degeneration of the glandular epithelium, is more apt to lead to the development of pseudomyxoma peritonei; the other, on the contrary, is due to simple obstruction of the appendiceal lumen, retention of secretion and mural dilatation, and it is less likely to give rise to this abdominal complication.

There are recorded cases of pseudomyxoma peritonei developing as late as seventeen years after removal of the original ovarian cyst.[13] As in the case reported below, the seeded epithelial cells can remain quiescent for many years, still preserving their potentialities of growth and secretion.

It is not within the purpose of this study to enter into the discussion of the mucinous or pseudomucinous nature of the exuded material. An elementary differentiation of mucin and pseudomucin is based on the property of the former to be precipitated by acetic acid. Pseudomucin is said to be alkaline in reaction, and mucin, acidic; hence the former assumes the acid dyes, and the latter the basic dyes. Accordingly, some authors have considered the inner kernel of the gelatinous globule to be a pseudomucin that stains red with eosin, and the outer layer to be a mucin that takes the basic hematoxylin dye. Based on these distinctive characteristics is the conclusion of Fraenkel[2] and Hughens[14] that the intraperitoneal gelatinous exudate, in connection with ovarian cysts, is a pseudomucin; that resulting from a ruptured mucocele is regarded as a mucin. If this could be accepted, the ability to determine the mucinous or pseudomucinous nature of the peritoneal content would be of significant diagnostic value in the cases in which the origin of the process is not clear, but this possibility is disproved by existing data. In 6 of the 142 mucoceles of the appendix analyzed by Dodge[15] in which the contents were examined, the material appeared to be a mucin in 3, a pseudomucin in 2 and a colloidal suspension in 1. Phemister[16] also found the secretion obtained from an appendiceal gelatinous cyst to be a pseudomucin. As for the mucinous or pseudomucinous nature of the secretion of the cystic ovarian tumors, the predominant opinion favors Schiller's[17] conclusion that any distinction between the two is not justified, the colloidal phase of the matter being responsible for the differences encountered from case to case.

New aspects in the controversial subject of pseudomyxoma peritonei are offered by the case presented below, inasmuch as it shows that a cholesterol phanerosis can occur in the intra-abdominal gelatinous exudate and that the seeded secreting cells can remain quiescent for many years, still preserving their potentialities of growth and function. As far as we know there are no preceding cases in the literature illustrating the coexistence of a cholesterous and mucinoid effusion.

Case Report

A 75-year-old woman was first admitted to this hospital on March 16, 1947, with the chief complaint of abdominal pain and loss of weight.

Nine years previously a twisted right ovarian cyst of the "pseudomucinous" type had been removed at another hospital. At that time the appendix was also removed and found to be normal. After this operation the patient felt well for about 3 years and then began to suffer from upper abdominal distress, which was attributed to a diaphragmatic hernia. For the past 2 years the appetite had been poor, and she had lost 30 pounds in weight. She had always been constipated, but no bloody, tarry or acholic stools had been noticed at any time. For the past 2 months she had begun to notice a sharp, nonradiating painful sensation in the right lower abdomen, which occurred every week or so and lasted 10 to 15 minutes.

Physical examination revealed a chronically ill, elderly woman. The abdomen was distended, with a shifting dullness, and a fluid wave could be elicited. The liver edge was not felt, and no abnormal masses could be palpitated in the abdominal cavity.

The temperature, pulse and respirations were within normal limits. The blood pressure was 165 systolic, 75 diastolic.

Examination of the blood showed a red-cell count of 3,250,000, with a hemoglobin of 10.5 gm. per 100 cc., and a white-cell count of 7000, with 72 per cent neutrophils, 24 per cent lymphocytes, 1 per cent monocytes and 3 per cent eosinophils. Urinalysis was insignificant except for a persistent low specific gravity (1.007 to 1.010). The blood sugar was 87 mg., the nonprotein nitrogen 20 mg., and the total protein 6 gm. per 100 cc.; the blood amylase was 12 units per 100 cc. Occult blood in the stools was shown on several occasions by a guaiac test. The cephalin-flocculation and blood Hinton tests were negative.

X-ray studies revealed a congenital shortening of the esophagus, with herniation of about half the stomach into the thorax, through the esophageal orifice of the diaphragm. A large, lobulated, ring-like area of calcific density was noticeable in the right middle portion of the abdomen anteriorly. This shadow was believed to be consistent with the presence of a calcified mesenteric cyst or similar type of intrinsic abdominal mass.

A peritoneoscopy was performed, but owing to the presence of an enormous quantity of gray-yellow gelatinous material in the abdominal cavity none of the organs or the peritoneal surfaces could be clearly visualized.

Pathological examination of a few nubbins of yellowish, firm tissue obtained at peritoneoscopy showed a structureless basophilic material imbedded in which lay abundant cholesterol crystals and lime-salt deposits (Fig. 1).

With the preoperative diagnosis of "pseudomyxoma peritonei" an exploratory laparotomy was performed. From 6 to 7 liters of gelatinous, yellowish-gray, translucent material was found in the abdominal cavity. Firm, yellow-gray, opaque formations, smooth on the surfaces and measuring 0.2 to 1 cm. across, were seen floating in this gelatinous material, which had a golden sheen throughout. As it was impossible to remove all this material by suction, it had to be scooped out by hand and by sponging. Both visceral and parietal peritoneum were studded with firmly adherent, tiny, whitish, seed-like growths, approximately 1 or 2 mm. in diameter, which could not be whisked off. The left ovary was identified and found to be normal (the right ovary had previously been removed). The liver could be inspected and was essentially normal except that its undersurface was bound tightly down with adhesions to the transverse colon and omentum. Attached to the right and middle portion of the transverse colon was a multiloculated cystic mass, which apparently lay in the gastrocolic omentum. The walls of the mass were not intact and showed several openings; they were thin and limp in places, and firm and calcified in others. The patient's condition at this time did not permit any attempt to remove the cystic mass, and the abdomen was closed.

Pathological examination of the pieces of tissue from the cystic mass and from a few peritoneal implants showed them to be composed of an interlacing of connective-tissue fibers and cells in the meshes of which lay structureless basophilic material. Mesothelial cells and foreign-body giant cells could be recognized here and there, being especially numerous around cholesterol crystals. No mucus-secreting epithelial cells could be identified. Bacteriologic examination of the intra-abdominal gelatinous exudate failed to reveal the presence of micro-organisms, tubercle bacilli included.

FIGURE 1. *Cholesterol Crystals and Lime-Salt Deposits in the Gelatinous Exudate within the Abdominal Cavity.*

Six months after operation the abdomen began to swell again, and when the patient was readmitted, 1 year later, it measured 40 inches in diameter at the level of the umbilicus in the recumbent position; a fluid wave was clearly elicited.

Examination of the blood disclosed a red-cell count of 4,050,000, with a hemoglobin of 15.5 gm. per 100 cc., and a white-cell count of 10,450, with a normal differential. Urinalysis showed a specific gravity of 1.005 to 1.015, and albumin from 0 to 110 mg., in different specimens. The sediment was not remarkable except for occasional white and red blood cells. The blood sugar was 80 mg., the nonprotein nitrogen 34 mg., the blood chloride 608 mg., the cholesterol 175 mg., the amylase 13.5 mg., the diastase 33 units, the calcium 98 mg., and the phosphorus 2.8 mg. per 100 cc. The acid phosphatase was 3.2 King-Armstrong units, and the alkaline phosphatase 2.9 Bodansky units per 100 cc. Occult blood in the feces was shown by the guaiac test. The blood Hinton test was negative.

Seven days after admission a laparotomy was performed. When the abdominal cavity was opened it was found to be filled with gelatinous material that had the same characteristics of that evacuated 1 year before. After removal of this material a multilocular cystic mass was found to surround the hepatic flexure of the colon. The pericolic cystic mass, together with the ascending colon and right third of the transverse colon, was resected, and an end-to-end ileocolostomy done with a complementary Weitzle type of catheter ileostomy in the ileum.

Still running a low-grade fever the patient was discharged home for convalescence on the 30th postoperative day.

Pathological examination of the pericolic cystic mass showed it to display a horseshoe shape, one branch of which measured 12 by 7 by 6 cm. and the other 14 by 8 by 7 cm. Both externally and on the cut section the mass consisted of poorly defined, intercommunicating cystic spaces from 0.5 to 2 cm. across. Some of the cystic spaces were empty, whereas others contained a gelatinous, yellow-gray material imbedded in which bits of chalk-like, whitish debris were noticeable.

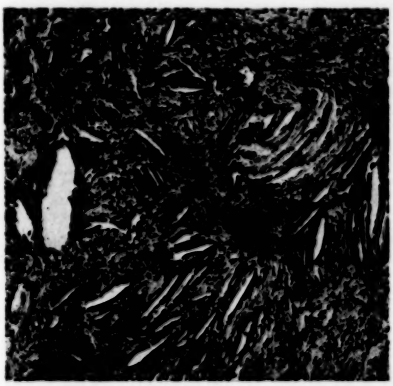

FIGURE 2. *Inflammatory Reaction at the Site of Crystallized Cholesterol Deposits.*

The walls of the cyst, upon microscopical examination, appeared to be composed of loosely packed connective-tissue fibers, poor in cells in some areas and rich in cells, mostly fibroblasts, in others. Islands of necrotic fat tissue were noticeable here and there, with disappearance of nuclei and replacement of normal structures by an amorphous basophilic material. Escaped fat globules of different sizes and shapes were noticeable throughout. There was concomitant inflammatory reaction, including granulocytic cell infiltration and proliferation of mononuclear phagocytes. Cholesterol crystals and foam cells were a prominent feature, and giant cells of the foreign-body type were noticeable here and there (Fig. 2). The great majority of the cystic spaces failed to reveal any cellular lining, and only occasionally a few regularly aligned tall columnar epithelial cells of the secretory type could be seen (Fig. 3). These cells compared exactly to the lining epithelial cells of the ovarian cyst removed 9 years before (Fig. 4), and no mitotic figures or any other finding pointing to cancerous degeneration could be recognized.

Microscopical examination of the intra-abdominal gelatinous globules showed them to be composed of an outer

basophilic staining laminated hull and of an eosinophilic center, which consisted of finely granular material with occasional cholesterol crystals.

Chemical analysis of the abdominal fluid, 8 liters in amount, was performed. A trace of nucleoproteins was obtained by

FIGURE 3. *Regularly Aligned Secretory Epithelium in a Peritoneal Implant, Exactly Reproducing That Seen in Figure 4.*

the acetic acid test, as well as by the Almen reagent, after heat treatment of the fluid to remove coagulated protein. However, a qualitative test for phosphorus on the coagulated protein was positive, indicating possibly that some of the nucleoproteins had been precipitated by heating to 100°C. The fluid had a total cholesterol of 229 mg., total phospho-

FIGURE 4. *Pseudomucinous Cyst Removed Nine Years before Admission.*

lipids of 62.5 mg., total lipoid fatty acids of 134 mg. and neutral fat of 27 mg. per 100 cc.

Bacteriologic examination revealed *Escherichia coli.*

The peritoneal cavities of 2 guinea pigs and 6 white mice were injected with 0.5 and 0.3 cc., respectively, of an emulsion of the abdominal exudate. All the animals remained healthy, and when they were killed, from 2 to 4 months after inoculation, no traces of the injected material or any visible tissue reaction could be found.

DISCUSSION

In the case reported above as in many comparable cases in the literature, the origin of the gelatinous exudate in the peritoneal cavity could be traced to a "pseudomucinous" ovarian cyst.

Nine years occurred between the removal of the ovarian cyst and the second operation. This shows that the seeded epithelial cells can remain quiescent for many years, still preserving their potentialities of growth and function.

To judge from the amazing amount of accumulated secretion evacuated from the abdominal cavity when the condition was first detected (from 6 to 7 liters) and by the promptness with which the abdomen filled up again within the year, with an additional 8 liters of similar material, one would have expected to find extensive seeding of secreting epithelial cells in the peritoneal surfaces. Instead, no secretory epithelium could be detected in the pieces of tissue removed at exploratory laparotomy, and only after many blocks of tissue had been cut through were a few cells with these characteristics seen in the removed pericolic cystic mass.

The failure to reproduce the condition in mice and guinea pigs after intraperitoneal inoculation of particles of the exudate is perhaps best explained on the basis of the paucity of secreting epithelium. A singular aspect was the presence of huge amounts of cholesterol crystals in the peritoneal exudate and in the enclosing peritoneal membranes.

Cholesterous effusions have been described in a variety of conditions, but except for a short account in the paper of Probstein and Lassar[18] on cholesterol-crystal inclusions within the gelatinous globules in a case of appendiceal myxoglobulosis, no mention could be found of a similar condition in any of the reported cases of pseudomyxoma peritonei.

Churton,[19] in 1892, is credited with the first description of a chronic pleural effusion characterized by the presence of cholesterol crystals. In 1941 Erwin[20] found 30 similar cases recorded, and since then only a case by Evander[21] has been added to this meager series. In practically all reported cases there was a history of long-standing effusion, showing little tendency to spontaneous reabsorption and repeatedly recurring after evacuation. The fluid, as a rule alkaline in reaction, was variously described as clear or turbid, with a color ranging from light yellow or brown to dark red. In some cases a few inflammatory cells, or fragments of cells, were seen. In others several hundred cells were present. The fluid was usually encysted by firm, fibrous bands, and the pleural surfaces were greatly thickened. In all cases the recognition of the process depended entirely upon the accidental discovery of the polyhedric cholesterol crystals in the absence of clinical symptoms or signs that might have made one aware or suspicious of the existing condition. Nearly all patients were middle-aged men; only a report by Sharpe[22] deals with a nine-year-old child, who

several years previously had had an operation for empyema.

The etiology of the process is not clear. In about 50 per cent of the cases pulmonary tuberculosis coexisted.[21] Diabetes or syphilis or a combination of these with tuberculosis has sometimes been considered a causal factor. Even though tubercle bacilli could not be demonstrated in many cases Erwin[20] has expressed the opinion that by virtue of chronicity, tuberculosis is the disorder most calculated to evoke such cholesterosis and that there is a reason to suspect a tuberculous basis in most of the published cases of cholesterous pleural effusion.

Protracted exudation, tendency to sequestration of the exudate, progressive thickening of the enclosing membrane and consequent delay in the normal process of reabsorption provide the pleural space with the conditions most favorable for the development of the process. It is not, however, the only location in which cholesterol crystallization has been recorded in association with an exudative process. Bignami[22] has found a comparable situation in a case of hydrocele (cholesterinic hydrocele), Fabris[24] in a case of pyonephrosis (cholesterinic pyonephrosis), and Lugo[25] within a cyst in the subdural space. Effusions of cardiac and renal origin are, in general, terminal complications of the underlying disease. Therefore, they seldom provide the conditions necessary to cholesterol deposition; nevertheless a few cases exemplifying this possibility have been reported.

Regardless of the location, the genetic mechanism of the process is apt to be the same in all cases. As for the source of the cholesterine in the exudate, a number of investigators have suggested a hematic origin.[20] Against this as the only source is the normality of cholesterol blood levels in the great majority of the reported cases (our own included), the higher cholesterol content of the exudate as compared to that of the blood itself and the fact that the progressive thickening of the enclosing membranes obviously embarrasses any interchange between the constituents of the circulating body fluids and the constituents of the exudate. This has been proved by an experiment by Bevere.[26] He added sodium salicylate to the pleural space of patients with cholesterinic pleurisy and noticed a marked slowing down in the urinary elimination of the introduced substance, as compared to that occurring after injection of the same chemical in a simple serous pleurisy.

The possibility of a synthetic origin of the cholesterine from the exudate itself has been suggested by Barbier and Tricaud,[27, 28] who noticed increase of the cholesterinic content in the fluid extracted from a patient with cholesterol pleurisy, but this has not been confirmed.[26] A participation of the corpusculated elements of the exudate in the formation of the cholesterine in the presence of proteolytic enzymes splitting the cellular proteins has also been considered; the amount of cholesterine contributed in this fashion is not sufficient, however, to account for the high cholesterinic content of the exudate. There are, in addition, recorded cases in which no cellularity was demonstrable in the exudate.

The tendency of the necrotic tissues to draw lime salts and neutral fats is well known; it might not be surprising, therefore, that the damaged tissues themselves enclosing the exudate would provide the conditions necessary to attract the cholesterine circulating in the body fluids and to provide additional cholesterine through the desquamation and melting in the exudate of degenerated cellular elements.

It is most likely that the cholesterine in the exudate derives from different sources including the blood stream, the corpusculated elements in the exudate and the membrane enclosing the exudate itself, each of these various sources or a combination of them playing the main role in the different cases. This conclusion also applies to the case reported above.

As for the conditions leading to the crystallization of the cholesterine in the exudate, it has been thought that the phenomenon is related to a rupture of the chemical physical balance of the constituents and that whenever the cholesterine reaches a critical concentration, crystallization occurs. Against this view is the absence of any quantitative relation between the free or combined cholesterinic fraction and the fraction of crystallized cholesterine.

Desbordes and Levy[29, 30] have shown that as effusions in the body cavities become old the total protein remains constant but an inversion occurs in the albumin-globulin ratio, and this is accompanied by a decrease of the cholesterolytic power of the fluid. This observation is in agreement with the results of the experiments of Mauriac[31] showing inversion of the albumin-globulin ratio to the advantage of the globulins, without notable lowering of proteins, in rabbits with induced hypercholesteremia. It seems, therefore, that a part of the cholesterol exists in the state of a "complex" associated with the albumin-globulin combination, this liaison being apparently related to the globulin and the albumin contributing to the holding in solution of the cholesterol.

All this has been advocated by Erwin[20] to explain the presence of crystallized cholesterol in his case of pleural effusion: "as the fluid ages, the globulin increases, the albumin decreases and a cholesterol phanerosis develops in the form of crystals giving the golden-sheen observed in several of the reported cases."

The same explanation can be advanced for the case reported above. Protracted exudation and progressive thickening of the enclosing membranes provided the ideal conditions to prevent the reabsorption of the exuded material and the interchange of constituents with the constituents of the circulating body fluids; hence the disruption in the albumin-

globulin liaison, which normally contributes to the holding in solution of the cholesterol, followed by its precipitation and formation of the characteristic rhomboidal crystals.

Summary

A case of "pseudomyxoma peritonei," most unusual for the presence of large deposits of cholesterol crystals in the exudate, is presented. Protracted exudation and progressive thickening of the enclosing membranes, interfering on one side with the reabsorption of the exuded matter and on the other with the interchange of its constituents with the constituents of the circulating body fluids, are advanced to explain this cholesterol phanerosis. The origin of the process could be traced to a "pseudomucinous" cystadenoma of the ovary removed nine years before. The long period intercurring between the removal of the cyst and the development of the abdominal condition shows that the seeded epithelial cells can remain quiescent for many years, still preserving their potentialities of growth and function.

References

1. Werth. Klinische und anatomische Untersuchungen zur Lehre von den Bauchgeschwülsten und der Laparatomie. *Arch. f. Gynäk.* **23**:431-442, and **24**:100-118, 1884.
2. Fraenkel, E. Über das sogenannte Pseudomyxoma peritonei. *München. med. Wchnschr.* **48**:965-970, 1901.
3. McCrae, T., and Coplin, W. M. L. Gelatinoid carcinoma (morbus gelatinosus) of peritoneum. *Am. J. M. Sc.* **151**:475-491, 1916.
4. Grodinsky, M., and Rubnitz, A. S. Mucocele of appendix and pseudomyxoma peritonei. *Surg., Gynec. & Obst.* **73**:345-354, 1941.
5. Rubnitz, A. S., and Hermann, H. T. Experimental appendical mucocele, myxoglobulosis and peritoneal pseudomyxoma. *Arch. Path.* **36**:297-310, 1943.
6. Gardham, A. J., Choyce, C. C., and Randall, M. Diverticulosis of appendix and pseudomyxoma peritonei. *Brit. J. Surg.* **16**:62-69, 1928.
7. Fraenkel, E. Über das sogenannte Pseudomyxoma peritonei. *München. med. Wchnschr.* **59**:1142-1145, 1912.
8. Harnik, M. Ovarialkarzinom neben Karzinom der Appendix. *Monatschr. f. Geburtsh. u. Gynäk.* **66**:345-350, 1924.
9. Waugh, T. R., and Findley, D. Mucocele with peritoneal transformation in adenocarcinoma of appendix. *Am. J. Surg.* **37**:519-525, 1937.
10. Heintz, V. G. Myxoglobulosis (Von Hanseman) of appendix. *Ann. Surg.* **96**:456-459, 1932.
11. Oberndorfer, S. *Handbuch der speziellen pathologischen Anatomie und Histologie.* Edited by F. Henke and O. Lubarsch. Vol. IV. Part 3. 1076 pp. Berlin: Julius Springer, 1929. Pp. 905-911.
12. Woodruff, R., and McDonald, J. R. Benign and malignant cystic tumors of appendix. *Surg., Gynec. & Obst.* **71**:750-755, 1940.
13. Ivers, J. B., Pomerat, C. M., and Neihardt, H. W. Hormonal relations to neoplastic growth with report of case study. *Tex. Rep. Biol. & Med.* **612**:206-233, 1948.
14. Hughens, H. V. Pseudomyxoma peritonei. *U. S. Navy M. Bull.* **28**:618-621, 1930.
15. Dodge, G. R. Cystic dilatation of vermiform appendix. *Ann. Surg.* **63**:334-348, 1916.
16. Phemister, D. B. Pseudomucinous cyst of appendix. *J. A. M. A.* **64**:1834-1836, 1915.
17. Schiller, W. Concepts of new classification of ovarian tumors. *Surg., Gynec. & Obst.* **70**:773-782, 1940.
18. Probstein, J. G., and Lassar, G. N. Mucocele of appendix, with myxoglobulosis. *Ann. Surg.* **127**:171-176, 1948.
19. Churton, C. Double haemorrhagic pleurisy: degeneration of cells with formation of cholesterine: subsequent empyema on right side, operation and recovery; followed by empyema on left side; operation, septicaemia and death. *Tr. Clin. Soc., London* **15**:19-26, 1882.
20. Erwin, G. S. Cholesterous pleural effusion. *Brit. J. Tuberc.* **35**:25-28, 1941.
21. Evander, L. C. Cholesterol pleural effusion. *Am. Rev. Tuberc.* **54**:504-508, 1946.
22. Sharpe, H. Two cases of cholesterin pleural effusion. *Brit. M. J.* **2**:462, 1919.
23. Bignami, A. Sopra un liquido pleurico ricco di colesterina. *Rif. di Osp.* **9**:662-673, 1919.
24. Fabris, A. Sulla pleurite colesterinica. *Policlinico (Sez. med.)* **42**:575-589, 1935.
25. Lugo, G. Lipoidosi e colesterinoflogosi essudative. *Arch. di pat. e clin. med.* **25**:293-361, 1944.
26. Bevere, L. Contributo allo studio della pleurite colesterinica. *Riforma med.* **47**:675-683, 1931.
27. Barbier, J. Empyème tuberculeux chroniques très riche en cholestérine. *Lyon méd.* **138**:157-159, 1926.
28. Barbier, J., and Tricaud, G. Les pleurésies à cholestérine. *Gaz. des hôp.* **100**:1233-1236, 1927.
29. Desbordes, J. Sur le mécanisme de solubilisation ou de précipitation du cholestérol dans le sérum ou les liquides pathologiques (pouvoir cholestérolytique). *Compt. rend. Soc. de Biol.* **127**:869-872, 1938.
30. Desbordes, J., and Levy, D. Sur le taux des protéines et l'equilibre serine/globuline dans divers liquides d'epanchements (liquide d'ascite, liquides pleuraux). *Compt. rend. Soc. de biol.* **127**:494-497, 1938.
31. Mauriac, P., Servantie, L., and Demenier, G. Variations du rapport sérine-globulin dans le sang de lapins hypercholestérolémiques. *Compt. rend. Soc. de biol.* **115**:177, 1934.

VENTRICULAR STRAIN AND VENTRICULAR HYPERTROPHY*

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WHEN medical terminology was less precise the expression "strained heart" was employed at times to describe obscurely but ominously diseased hearts. This diagnosis is no longer made, but currently the terms heart strain and ventricular strain are occasionally used to identify electrocardiographic patterns encountered in various types of heart disease.[1] The dictionary defines strain as "the hurt or injury from excessive tension or use, as of muscles, nerves and organs; deformation or distortion due to stress or force; stretched beyond its proper limits." Stress is "the force, pressure or influence impinging upon or acting against the member or organ under consideration."

The heart is normally subjected to stresses against which it operates to perform its work. In the absence of myocardial disease these are adequately countered without injury or strain. Furthermore, the reserve capacity of the normal heart enables it to cope successfully with greatly increased stresses as during excitement, violent exercise, anemia, pregnancy and infection. In a like manner, patients with moderate hypertension, valvular insufficiency or chronic pulmonary disease may go for many years without any evidence or symptoms of cardiac involvement. However, if the stresses exceed physiologic reserves, strain occurs, which may be acute, as in pulmonary embolism, or chronic, as in important hypertension. These become objectively manifest as dilatation and, if the condition is chronic, dilatation and hypertrophy (distortion). This stage may or may not be accompanied by symptoms. Strain may occur with an essentially normal myocardium. On the other hand, disease of heart muscle renders the heart less capable of coping with *normal* physiologic stresses. In either event strain represents a state of imbalance. It should be apparent that although it is usually the result of organic disease, heart strain is actually a functional disorder that is often reversible.

Although the term heart strain should not properly be applied to an electromechanical tracing, specific electrocardiographic patterns are encountered either as the result of or occurring coincident with the cardiac "hurt or injury" of ventricular strain. The exact cause for the observed abnormalities is obscure. They may somehow be related to mechanical stretching or distortion of the myocardium or to more subtle alteration of the metabolic processes. In either event they are limited almost wholly to the repolarization process and result in depressions of the ST segment and T-wave inversions.

In 1935 the electrocardiographic findings in acute pulmonary embolizations were described.[2] These consisted of the development of an S wave in Lead 1 and a Q wave in Lead 3 and of deviations in the ST segments in Lead 1 and 3. There were also T-wave inversions in L_{III} and L_{aVF}. Later studies indicated that the S wave in Lead 1 and Q wave in Lead 3 were manifestations of cardiac rotation and not of myocardial distress. Clockwise rotation of the heart on its long axis was also observed as shown by development of S waves in the leads from the left side of the chest. Inversion of the precordial T waves was, apparently, the only valid evidence of heart *strain* and was limited to leads obtained over or derived from the right ventricle. In some cases of chronic cor pulmonale resulting from persistent pulmonary hypertension, considerable right ventricular hypertrophy occurs, and in addition to the electrocardiographic findings noted in the acute form the R waves in the right precordial leads become prominent and the S waves small.[3-5]

It is apparent, therefore, that uncomplicated *strain* of the right ventricle results in ST-segment and T-wave changes in the leads from the right precordium, whereas right ventricular *hypertrophy* produces alterations in the QRS complexes. For the sake of completeness it is well to note that other electrocardiographic forms are encountered in right ventricular disease. For example, the electrocardiogram may be entirely normal in both acute and chronic cor pulmonale. Chronic strain of the right side of the heart with moderate hypertrophy may result in an electrocardiographic pattern that is indistinguishable from acute strain, and both resemble the findings commonly seen in children and in some adult Negroes. Partial or complete right-bundle-branch block is sometimes found in both acute and chronic cor pulmonale but appears also in coronary-artery disease.

Investigators are in agreement regarding the electrocardiographic criteria that may be used to distinguish right ventricular strain (Fig. 1) from right ventricular hypertrophy (Fig. 2). The agreement is not quite complete, however, with left ventricular disease. The term left "heart strain" has now been largely replaced by "hypertrophy." This may be because "strain" has obscure implications whereas "hypertrophy" is obvious and can be co-ordinated with physical, x-ray and autopsy findings. Furthermore, regardless of its exact meaning, strain of the left ventricle is almost always accompanied by hypertrophy.

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From an electrocardiographic point of view, there is, unfortunately, no clinical state involving the systemic circulation quite comparable to that which obtains in the lesser system after extensive pulmonary embolization. A somewhat similar situation might arise during the hypertensive crisis of pheochromocytoma. However, few striking electrocardiographic changes are encountered here, possibly because the left ventricle is better able to handle acute insults than the right. Nevertheless, it appears probable that strain of the left ventricle occurs in other situations and that it results in a distinguishable electrocardiographic picture.

The pattern of left ventricular hypertrophy has recently been reviewed and more carefully defined.[3, 4, 6] It is considered to be present when the QRS complexes from the left side of the precordium (V_5 or V_6 or both) consist largely or entirely of R waves of unusual height and duration (greater than 27 mm. in height, with intrinsic deflection of 0.04 second or more after the origin) or when the sum of S in V_1 and R_5 exceeds 35 mm. (See Fig. 6.) Commonly, these changes are also accompanied by a depressed or sloping ST segment and an inverted T wave in Lead V_5 or V_6. (See Fig. 7.) Usually, the heart is horizontal, but the same changes may occur with the heart in the intermediate or even in the normal vertical position. Although this is the commonly accepted electrocardiographic pattern of left ventricular hypertrophy there are important exceptions. Electrocardiograms are seen that fulfill the ST-segment and T-wave requirements without having R and S waves of abnormal size. Contrariwise, an occasional record is encountered with R and S waves of heroic proportions but with ST segments and T waves that are normal. It is suggested that the first of these variants represents, in fact, left ventricular strain without hypertrophy and that it may be reversible. As a corollary it is likely that the second indicates hypertrophy without coincident strain.

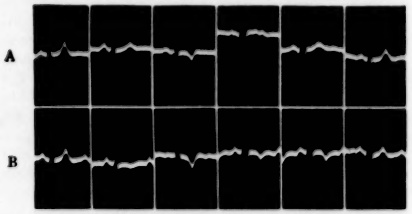

FIGURE 1. *Right Ventricular Strain in a Forty-Seven-Year-Old Man with Pulmonary Fibrosis.*

A=record taken early in the disease. B=record taken five months later. Note the development of S wave in Lead 1 and Q wave in Lead 3 and inversion of the T waves in Lead 2 and 3, as well as the deepening of S waves in V_4 and V_5, with inversion of the T wave in V_2 and V_4.

In support of these contentions a series of clinical situations is submitted for consideration. In some of these, electrocardiographic patterns similar to hypertrophy (ST-segment and T-wave changes but R waves of ordinary amplitude) were observed to develop acutely or to disappear. The time consumed was brief, and there were no measurable differences in heart size. In another group of patients a similar electrocardiographic picture was present in spite of the absence of hypertrophy, hypertension or valvular disease.

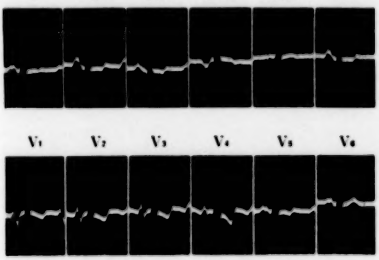

FIGURE 2. *Right Ventricular Hypertrophy in a Thirty-Two-Year-Old Man with Mitral Stenosis.*

Note the prominent R, small S and inverted T waves in Lead V_1, V_2 and V_3, with deep S and upright T waves in V_6. Large or biphasic P waves, or both, are the result of auricular hypertrophy.

Hypertrophy-Like Pattern with Hypertension or Valvular Disease

A left hypertrophy-like pattern has been observed in patients with hypertension or aortic-valve disease *and* congestive failure upon recovery of compensation. Occasionally, patients in congestive (right ventricular) failure secondary to left failure resulting from hypertension or aortic-valve disease demonstrate normal electrocardiograms. However, upon recovery electrocardiographic findings resembling left ventricular hypertrophy become apparent in days to weeks. The following case is used to illustrate this phenomenon.

CASE 1. A 69-year-old former laborer, with a past history including hypertension, thrombophlebitis and pulmonary embolism, was admitted to the hospital because of weakness and evidence of myocardial failure. There was extensive cerebral arteriosclerosis and senility. Physical examination revealed a heart that was at the outer limits of normal in size (confirmed by x-ray study), pulmonary moisture and extensive edema of the legs and thighs. The blood pressure was 180/110. The electrocardiogram on admission was essentially normal (Fig. 3*A*). He responded well to treatment of his

cardiac failure with clearing of both the pulmonary and peripheral edema. At this time the electrocardiogram developed findings resembling those of left ventricular hypertrophy with ST-segment and T-wave changes but R waves of normal amplitude (Fig. 3*B*). In spite of cardiac improvement decubitus ulcers developed, and the patient died, apparently of sepsis. Permission for autopsy was not obtained.

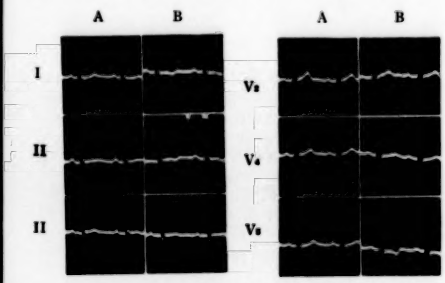

FIGURE 3. *Electrocardiograms in Case 1.*

During congestive failure the record is essentially normal (A). *Upon recovery from failure* (B) *there are sloping ST segments and inverted T waves in Lead 1, 2 and V5. The size of the QRS complexes is unchanged and within normal limits. This is the pattern of left ventricular strain.*

HYPERTROPHY-LIKE PATTERN WITHOUT HYPERTENSION, HYPERTROPHY OR VALVULAR DISEASE

The situation in which a left hypertrophy-like pattern is present has been observed with considerable frequency in patients with angina pectoris but no hypertension, hypertrophy or valvular disease. The following case illustrates this situation.

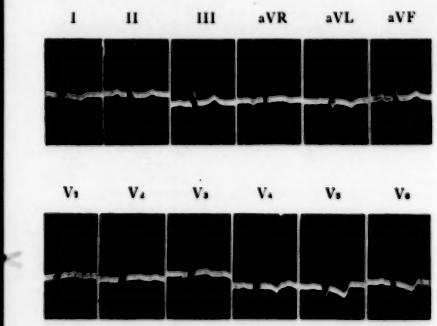

FIGURE 4. *The Pattern of Left Ventricular Strain without Hypertrophy (Case 2).*

Note the sloping ST segments and inverted T waves in Lead 1 and aVL and in the left precordial leads. The QRS complexes are of normal amplitude.

CASE 2. A 58-year-old storekeeper was admitted to the hospital with complaints of rectal bleeding and retrosternal distress related to cold weather and effort. There were no symptoms of myocardial insufficiency. The bleeding was found to result from benign rectal polyps. Examination of the heart revealed it to be of normal size, and the rhythm was regular. There was a soft systolic apical murmur. The aortic second sound was greater than the pulmonic. The blood pressure was 130/70. X-ray study of the chest showed a heart of normal shape and size. The transverse diameter of the heart was 14 cm. and the internal diameter of the chest was 31 cm. The angina was easily controlled with nitroglycerin. The electrocardiogram (Fig. 4) was similar to that in Case 1.

HYPERTROPHY-LIKE PATTERN IN ANGINA DECUBITUS

The development of an electrocardiographic pattern resembling that of left hypertrophy during the course of angina decubitus is a rarely encountered phenomenon that may be found in the absence of hypertrophy, hypertension and so forth. It may occur in a few days and has been noted to disappear together with improvement in the clinical state.

The following case is typical of those in this group.

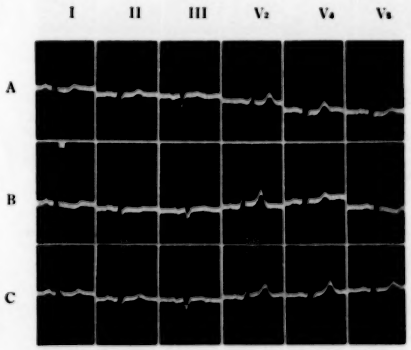

FIGURE 5. *Electrocardiograms in Case 3.*

On admission the record is normal except for evidence of digitalis (A). *Five days later during a period of angina decubitus, there are sloping ST segments and inverted T waves in Lead 1, 2 and V5* (B). *Three months later, the electrocardiogram is within normal limits* (C).

CASE 3. A 56-year-old government employee had been aware of retrosternal pain on effort for 3½ years. This gradually increased in frequency and severity, and 3 weeks before admission the patient could walk only 1 block without pain. Two days prior to entry pain began to occur at rest and became almost continuous. This was barely relieved by nitroglycerin and digitalis supplied by his family physician. The patient was an obese white man who showed the slightest possible trace of ankle edema. However, there was no dyspnea or orthopnea. On x-ray examination the heart was just within normal limits of size. The transverse diameter of the heart was 15 cm., and the internal diameter of the chest was 31 cm. The heart was in the horizontal position. It was narrow waisted and of normal area. The blood pressure was 152/92

on admission and dropped to 130/80 shortly thereafter. During the 1st week the patient had 20 to 30 attacks of angina each day while confined to bed, but the frequency gradually decreased until by the 7th week he was entirely free of pain. He was discharged after 9 weeks in the hospital. The electrocardiogram on admission showed digitalis effect but was not otherwise striking (Fig. 5*A*). Five days later there were sloping ST segments and inverted T waves in leads V_5 and V_6 (Fig. 5*B*). Three months after admission, when the patient was essentially free of complaints, the electrocardiogram was again normal (Fig. 5*C*).

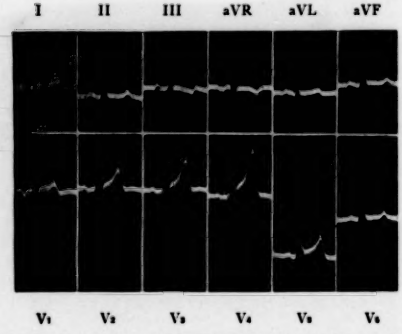

FIGURE 6. *Electrocardiograms in a Patient with Hypertension and Cardiac Hypertrophy, Showing Left Ventricular Hypertrophy Without Strain.*

The limb leads are normal with the heart in the semi-vertical position. There is a huge S wave in Lead V_2 (3.2 m.v.), and R wave in Lead V_5 (3.9 m.v.). The T waves are upright in all precordial leads.

DISCUSSION

The cases used above to illustrate the development and recession of an electrocardiographic pattern are obviously unusual. Cardiologists are much more familiar with patients in comparable clinical situations who have not shown similar changes. However, these differences can be reconciled. Generally, patients with sufficient hypertensive disease to result in congestive failure have well marked hypertrophy patterns (Fig. 7), which cannot be expected to alter greatly. In a like manner patients with angina decubitus ordinarily have enough coronary-artery disease to result in grossly abnormal electrocardiograms, which ordinarily change only to become worse. One can expect rapid and significant development, therefore, only in the rare cases in which the tracings are still essentially normal but delicately balanced and in which little additional strain is required to precipitate electrocardiographic evidence of this phenomenon.

The following explanation is offered to account for the presence of the electrocardiographic pattern resembling that of left hypertrophy in the clinical states described above.

In the cases of congestive (right ventricular) failure secondary to disease of the left ventricle the presence of a heart-strain pattern *prior* to decompensation has not been proved. It may or may not have been present. Most observers are in agreement that cardiac output is either absolutely or relatively diminished during such failure. It follows naturally that the *work* of the left ventricle is proportionately lessened and that the left ventricle is temporarily relieved of its customarily increased stress. Accordingly, the *strain* of the left side of the heart is similarly partly or completely alleviated, and the electrocardiogram may be normal. Upon recovery of compensation, however, the left ventricular output and work increase, and with these there is electrocardiographic evidence of strain. This sequence of events is reminiscent of a somewhat similar phenomenon observed in patients with angina pectoris who develop congestive failure. Commonly, the angina wanes with the onset of decompensation. It reappears with recovery from failure probably because of the simultaneously increased output and work of the left ventricle.

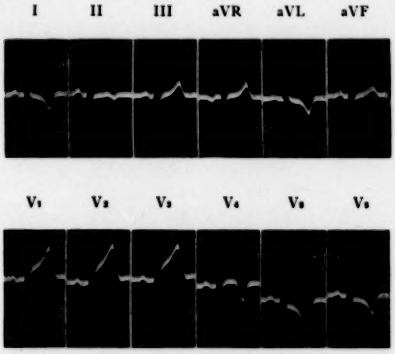

FIGURE 7. *Left Ventricular Hypertrophy and Strain in a Patient with Hypertensive Heart Disease and Marked Cardiac Hypertrophy.*

Note the prominent R waves sloping and bowed ST segments and inverted T waves in Lead I and aVL (RaVL 1.9 m.v.), deep S wave in V_2 (2.5 m.v.; trough off record as shown), tall R waves in Lead V_5 (3 m.v.; peak off record) and depressed, bowed ST segments and inverted T waves in the left precordial leads.

In angina pectoris the presence of abnormal left ventricular physiology is clear. Here the often extensive coronary-artery insufficiency results in an ischemic and diseased myocardium that is unable to cope with normal stresses (angina decubitus) or moderately increased stresses (angina of effort), and strain ensues.

The frequency of the electrocardiographic pattern of ST-segment and T-wave abnormalities in Lead

V_5 and V_6 in patients with angina but without hypertrophy is too great to be wholly fortuitous. Some cardiologists, in fact, prefer to interpret such findings as "consistent with coronary-artery disease."

In Case 3 described above the strain pattern developed during a period of critical coronary-artery inadequacy. Subsequently, after all pain had disappeared, the electrocardiogram became normal. It is highly improbable that myocardial hypertrophy developed in six days and then disappeared. It is thought that during a period of grave coronary insufficiency the heart was unable to meet its basal physiologic requirements and was strained by *normal* stresses. This was accompanied by an electrocardiographic pattern thought to indicate left ventricular strain. When an adequate collateral circulation became available the enhanced ability of the heart to perform its work led to both clinical and electrocardiographic improvement. Unfortunately, such close parallels between clinical and electrocardiographic states are rarely encountered.

The pattern of depressed or sloping ST segments and inverted T waves but without abnormally prominent R waves in the outer (left) precordial leads is taken as the electrocardiographic manifestation of left ventricular strain without hypertrophy. This may be reversible. When unusually prominent R waves are also present, hypertrophy and strain coexist. One phenomenon that has not thus far been considered is the lowering of ST segments and T waves resulting from a simple enlargement of the R waves in hypertrophy. Although this is a real influence it presently remains an uncertain and, in any one case, an unmeasurable factor. The ventricular gradient, which is customarily normal in left ventricular hypertrophy, is computed from the limb leads. This discussion primarily concerns the precordial phenomena. These have been shown to differ widely at times from those derived from the limbs. The findings in hypertrophy are ordinarily permanent except when cardiac enlargement can be reduced. This sometimes occurs after sympathectomy in hypertensive patients.

One may, accordingly, conceive of the pattern of left ventricular strain as electrocardiographic evidence of the unphysiologic state that obtains with left ventricular inability to cope with normal or abnormal stresses. In this manner it is possible to account for the occasional appearance of an electrocardiographic picture not grossly dissimilar from that of left hypertrophy in patients without cardiac enlargement. Such persons generally have coronary-artery insufficiency or intrinsic myocardial disease.

Summary

Ventricular strain is a pathologic state of imbalance that occurs with myocardial inability to contend with normal or abnormal stresses. It may cause reversible electrocardiographic alterations.

Right ventricular strain due to abnormal stress is commonly seen with acutely or chronically elevated pulmonary pressures. Isolated strain of the left side of the heart occurs in coronary-artery inadequacy because of diminished ventricular ability to cope with normal stresses.

Aside from changes due to cardiac rotation, right ventricular strain becomes manifest electrocardiographically by ST-segment and T-wave changes in the right ventricular precordial leads. When significant (probably great) hypertrophy is added, the R waves in the same leads become abnormally tall and broad, whereas the S waves diminish in size.

An electrocardiographic picture superficially resembling that found in left hypertrophy has been observed to develop from apparently normal records in patients with left ventricular disease recovering from congestive failure. It is seen in others who have no cardiac enlargement. The same pattern has also been seen to emerge in patients with rapidly increasing angina pectoris and to clear with clinical improvement.

Observations in these clinical states suggest that distinguishing differences can be noted between strain and hypertrophy of the left ventricle similar to those on the right side.

The ST-segment and T-wave abnormalities in precordial Lead V_5 or V_6, or both, are considered to be manifestations of left ventricular strain. Enlargement of the R waves in the same leads constitutes evidence of left ventricular hypertrophy. These are usually seen together but may occur separately.

References

1. Katz, L. N. *Electrocardiography Including an Atlas of Electrocardiograms.* Second edition. 883 pp. Philadelphia,: Lea & Febiger, 1946.
2. McGinn, S., and White, P. D. Acute cor pulmonale resulting from pulmonary embolism: its clinical recognition. *J. A. M. A.* 104:1473-1480, 1935.
3. Wilson, F. N., et al. Precordial electrocardiogram. *Am. Heart J.* 27:19-85, 1944.
4. Goldberger, E. *Unipolar Lead Electrocardiography Including Standard Leads.* 182 pp. Philadelphia: Lea & Febiger, 1947.
5. Myers, G. B., Klein, H. A., and Stofer, B. E. Electrocardiographic diagnosis of right ventricular hypertrophy. *Am. Heart J.* 35:1-40, 1948.
6. Sokolow, M., and Lyon, T. P. Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. *Am. Heart J.* 37:61-186, 1949.

CONDITIONED-REFLEX TREATMENT OF ALCOHOLISM
I. Its Rationale and Technic*

JOSEPH THIMANN, M.D.†

BOSTON

FEBRUARY, 1949, marked the end of seven years of application of the conditioned reflex as a therapy for alcohol addiction at the Washingtonian Hospital. This fact calls for an evaluation of this part of the total therapeutic plan[1, 2] concerning chronic alcoholism.

The present article is the first of two dealing with the rationale, technic, indications, contraindications, risks and psychologic aspects of the treatment, as well as its efficacy and methods of evaluating it.

The last two decades have made it quite fashionable for any intelligent lay person, and a veritable shibboleth for a modern professional man, to announce that alcoholism is a disease and that alcoholic patients are sick people. The professional and lay therapist alike consider it necessary to aim at one target: the underlying cause of the patient's addiction. Focusing on this, they analyze the patient for old and recent traumas and try to determine how far these traumas have initiated a discouraging or frustrating mechanism. An attempt, then, at eliminating the neurotic defense mechanisms and building new constructive patterns of life is considered to constitute the treatment of addiction.

Unfortunately, the majority of alcohol addicts continue to relapse even after psychotherapy of one kind or another.

Careful observations of large numbers of patients have confirmed the impression that the psychopathology of alcohol addiction resembles, in certain aspects, that of addiction to narcotics. If a person suffering from gallstones is given morphine for a certain length of time and happens to be predisposed to addiction, the addiction will develop. In such a case it is agreed that removal of the gall bladder will in most cases eliminate the pain, but not the addiction to morphine. By then, the addiction will have developed into an autonomous disease, independent of whether the underlying cause, the gallstone colic, still exists or has been removed. I think that there is reason to assume that the uncontrollable desire for alcoholic beverages is governed by similar laws. It may, of course, be precipitated by an underlying neurosis or some combination of inner and outer factors. From the point at which the addictive pattern has become established, however, it is as autonomous as morphine addiction. From then on the addict does not drink because of his neurosis or whatever has caused his addiction; he does not even drink, as a physician once put it, "in order to get drunk." He drinks because he is addicted, because the established addiction is self-perpetuating and causes the compulsive need for more and more alcohol. Thus, the impulse for alcohol can best be described as an abnormal conditioned reflex.

If this theory is accepted as a working hypothesis, one will not expect many alcohol addicts to stop drinking after undergoing psychoanalysis or some other psychotherapy without specific treatment for the addiction as such, just as morphine addicts are not expected to give up morphine because the underlying gall-bladder disease and pain have been eliminated. Accepting this hypothesis of the autonomous character of the alcohol compulsion as such does not, of course, mean underrating the importance of psychotherapy in the treatment of the underlying personality disorder, either the primary one, existing in the prealcoholic personality, or the secondary neurosis, which may have developed as a result of the feelings of helplessness, guilt or inferiority incident to the addiction.

The idea of outweighing the craving for alcohol by means of a revulsion established artificially against it is at least as old as Pliny the Elder, who in his *Historiae Naturalis*[3] lists quite a few, (somewhat naïve) methods. Beginning in 1930, several European therapists,[4-7] among them Dent[8] in England, reported their experiments in establishing a conditioned reflex against alcoholic impulses.[1] In this country Fleming,[9] of Boston, seems to have been the first to apply Dent's technic of apomorphine injections to 36 patients, with an estimated success of 35 per cent.

The first reports about highly successful treatment of a large number of alcoholic patients, with subsequent observation over a period of more than four years, emanated from the Shadel Sanitarium in Seattle, Washington,[10-12] from 1940 to 1942, an average of 64.3 per cent of total abstinence from alcoholic beverages‡ among patients treated being claimed. The authors reported the use of a 7.8 per cent solution of emetine, supplemented by pilocarpine and ephedrine as the unconditioned stimulus, the alcoholic beverages constituting the conditioned one. Emetine appeared more appropriate than apomorphine, which was used by Dent, because it caused the desired prolonged nausea and because it lacked the disturbing euphoric and hypnotic aftereffects. Several simultaneous exposures to the un-

*These articles represent abstracts from a book that is in the process of being prepared for publication.

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‡A recent report from the same institution claims a 44.8 per cent efficacy in an observation period of ten and a half years.[13]

conditioned and conditioned stimuli entailed a reflex association between both. Whether this association developed to the extent of an active and conscious revulsion to and nausea at the sight, taste, smell and even thought of alcoholic beverages, as it usually does shortly after its establishment, or whether it merely developed to the extent of outweighing the compulsive reach for a drink, depends on the technic and — it seems to me — also on the patient's personality. Pavlov already knew that conditioned reflexes are apt to "fade out" if they are exposed for a certain length of time to the conditioned stimulus only, without the reinforcing action of a simultaneous unconditioned stimulus. To prevent the treatment from losing its efficacy, the initial series was followed up by additional sessions (reinforcements), given in intervals during the first year.

Seven years ago, the conditioned-reflex therapy was started at the Washingtonian Hospital.[14] It was modified in technic to increase its efficacy. Furthermore, it was supplemented by methodic psychotherapy and part-time hospitalization,[15] as well as by manipulation of the patient's environment. This included case work with relatives, whenever these measures seemed indicated. Group therapy was organized in the form of semimonthly meetings of the hospital abstinence club comprising all patients who "graduated" from the initial series of the conditioned-reflex therapy. The term "part-time hospitalization" describes an arrangement that combines the advantages of a protective environment with those of the exposure to the unsupervised, normal environment. These patients work full time at their regular place of work, but spend their free time in the hospital. The period of hospitalization is gradually reduced; thus, the patient becomes increasingly able to handle in a mature way all the usual daily problems of an adult.

It may be appropriate to describe here one conditioning session as given at the Washingtonian Hospital.

The treatment room should be arranged in such a way as to eliminate all distracting stimuli.[14] The treatments are given in the morning, because patients react better when fasting and rested. The preliminary medication consists of 10 to 20 mg. of Benzedrine sulfate and 1 mg. of strychnine sulfate followed by a capsule containing 0.06 to 0.15 gm. (60 to 150 mg.) of emetine hydrochloride with 1 to 3 glasses of tepid water. Simultaneously, 0.05 to 0.15 gm. (50 to 150 mg.) of emetine hydrochloride is administered hypodermically. These dosages are easily obtained from a 7.2 per cent solution of emetine supplemented by 1 per cent pilocarpine and 4.8 per cent ephedrine sulfate. Of this solution, 0.6 cc. contains 50 mg. of emetine; 1 cc. contains 75 mg., and 2 cc. 150 mg. of emetine — the highest single dosage I have ever administered. The percentages in this solution have been arrived at purely empirically. Experiments with higher concentrated solutions have shown slower or less complete absorption. In other words, 50 mg. of emetine in a 13 per cent solution produced a slower and less powerful reaction than the same amount in a 7.2 per cent solution. On the other hand, solutions of less concentration than 7.2 per cent appeared too bulky and therefore uncomfortable.

Immediately prior to the expected emesis the patient is exposed to the sight, smell and taste of the alcoholic beverages that he preferred when on a spell of drinking. The drinks are offered in undiluted form ("straight") and in the usual dilutions ("highballs").

These sessions last twenty to thirty minutes and are repeated daily* for five or six days. They are followed by six or seven preventive one-day treatments, so-called reinforcements, given at intervals ranging from four to twelve weeks. Thus, the application of the initial series together with the reinforcements takes approximately a year. Some patients, anxious to obtain the widest possible margin of safety, ask after the first year of treatment for further reinforcements. Such second-year-treatments have consisted of a series of four reinforcements given at three-month intervals.

I should like to stress the fact that it would be erroneous to assume that this detailed description of the technic enables one to apply it safely and efficiently without an adequate apprenticeship. The reasons for caution are indicated by the great range and variety of the patient's reaction to the conditioned and unconditioned stimuli, innumerable imponderables decisive for the success or failure of the treatment, and the very narrow margin between underdosage and overdosage.

The next article in this series will deal with the physiologic risks of the treatment, indications, contraindications, efficacy and psychotherapeutic aspects.

*Provided no toxic symptoms ensue. Otherwise, the sessions were postponed for the necessary length of time. These toxic side effects will be discussed in a later article.

References

1. Thimann, J. Constructive teamwork in treatment of alcoholism. *Quart. J. Stud. Alcohol* **8**:569-579, 1948.
2. Thimann, J., and Price, G. M. Modern trends in treatment of alcohol addicts. *J. Social Casework* **27**:222-229, 1946.
3. Pliny the Elder. Cited by Thimann, J. In *Current Therapies of Personality Disorders*. 296 pp. New York: Grune & Stratton, 1946. Pp. 101-116.
4. Schwarte, F. Ein Beitrag zur medikamentösen Behandlung des Alkoholismus. *Fortschr. d. Med.* **56**:321-324, 1938. (Cited by Voegtlin, W. L., and Lemere, F. Treatment of alcohol addiction: review of literature. *Quart. J. Stud. Alcohol* **2**:717-803, 1942.)
5. Kantorvich, N. V. Cited by Voegtlin, W. L., and Lemere, F. Treatment of alcohol addiction: review of literature. *Quart. J. Stud. Alcohol* **2**:717-803, 1942.
6. Siuchevskiy, I. F., and Friken, A. A. Cited by Voegtlin, W. L., and Lemere, F. Treatment of alcohol addiction: review of literature. *Quart. J. Stud. Alcohol* **2**:717-803, 1942.
7. Galant, J. S. Über die Apomorphinbehandlung der Alkoholiker. *Psychiat.-neurol. Wchnschr.* **38**:85-89, 1936.
8. Dent, J. Y. Cited by Voegtlin, W. L., and Lemere, F. Treatment of alcohol addiction: review of literature. *Quart. J. Stud. Alcohol* **2**:717-803, 1942.

9. Fleming, R. Personal communication.

10. Voegtlin, W. L. Treatment of alcoholism by establishing conditioned reflex. *Am. J. M. Sc.* **199**:802-810, 1940.

11. Voegtlin, W., et al. Conditioned reflex therapy of alcoholic addiction: follow-up report of 1042 cases. *Am. J. M. Sc.* **203**:525-528, 1942.

12. Voegtlin, W. Conditioned reflex therapy of chronic alcoholism: preliminary report on value of reinforcement. *Quart. J. Stud. Alcohol* **2**:505-511, 1941.

13. O'Hollaren, P., and Lemere, F. Conditioned-reflex treatment of chronic alcoholism: results obtained in 2323 net cases from 3125 admissions over period of ten and a half years. *New Eng. J. Med.* **239**: 331-333, 1948.

14. Thimann, J. Conditioned reflex as treatment for abnormal drinking: its principle, technic and success. *New Eng. J. Med.* **228**:333-335, 1943.

15. Thimann, J. Part-time protective environment and working parole as adjuvant in treatment of alcoholism. *New Eng. J. Med.* **231**: 9-11, 1944.

MEDICAL PROGRESS

RESUSCITATION*

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CARDIORESPIRATORY ARREST

IN THE multitude of clinical and experimental material reported in the last two decades, cardiac arrest and respiratory arrest are usually regarded as two distinct entities. It is true that certain events result in cardiac arrest, whereas other circumstances lead to cessation of respiration; however, because these two are so closely related in pathological physiology and in therapy, thinking on the problems engendered must, in every instance, include both. Synonymous with Courville's[1] phraseology, "respiro-cardiac crises," the term cardiorespiratory arrest is suggested as most appropriate and is used below in referring to this phenomenon.

Cardiorespiratory arrest is one of the most catastrophic events that may occur in medicine and presents the greatest possible emergency. It is characterized by the absence of the two vital functions, circulation and respiration; the patient is apparently dead.

Cardiorespiratory arrest often occurs as an operating-room accident because circumstances of anesthesia and surgery predispose to its development. Of the operating-room accidents in which the arrest occurs as a terminal event in a mortal disease[2] — for example, in coronary occlusion incidental to an operation, late intestinal obstruction or overwhelming sepsis — this condition may be considered irreversible, and little benefit may be expected from resuscitation. On the other hand, when cardiorespiratory arrest occurs accidentally as a result of factors such as anoxia, drug effect, idiosyncrasy to drugs and abnormal reflex action, there is a period following the onset of the arrest during which the condition is reversible. Hence, if effective resuscitation is promptly instituted recovery will follow.

The wealth of clinical observation emanating from the operating room in the nature of case reports and discussions, in addition to the knowledge gained from experimental investigations, enables one to form a clearer concept of the problems involved and to place the treatment of this condition — namely, resuscitation, the revival of the apparently dead — on sound physiologic principles.

Cardiorespiratory accidents do not confine themselves to the operating room. In the delivery room, asphyxia of the newborn requires prompt resuscitation therapy; in the home, in industry and elsewhere accidents such as electric shock, drowning, inhalation of foreign material, inhalation of noxious gases, injuries to the chest and poisonings present emergencies in which a knowledge of resuscitation may make the difference between life and death. Therefore, the discussion that follows deals first with this emergency in the operating room, secondly, with the emergency in the delivery room and, finally, with accidents occurring elsewhere.

Pathological Physiology

Anoxia produced by cardiorespiratory arrest. A state of oxygen deficiency occurring in the tissues from whatever cause is designated as hypoxia; continuation of hypoxia to a state of oxygen lack incompatible with life is called anoxia. In the literature, the term anoxia is generally used to designate both hypoxia and anoxia; in the ensuing discussion, this usage of the word is followed.

Many clinical conditions lead to various degrees of anoxia. The most frequent cause is decrease in oxygen supply when oxygen demand is normal.[3] Examples are as follows: insufficient oxygen in the atmospheric air (environmental cause) such as high altitude; insufficient intake of oxygen to the al-

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veoli of the lungs (respiratory cause) such as respiratory arrest, respiratory depression, respiratory obstruction, emphysema, asthma, pneumonia, atelectasis and pulmonary fibrosis; inadequate transportation of oxygen from the alveoli of the lungs to the tissues (circulatory cause) such as cardiac arrest, failing circulation, myocardial weakness, valvular disease, pericarditis, arterial spasm and arteriovenous fistula; and depressed tissue activity such as frostbite and edema.

Less frequent causes of anoxia are associated with a normal oxygen supply, but an increased oxygen demand of the tissues (over-utilization anoxia)[4] — for example, exercise, fever, hyperthyroidism and infection. Whereas, the anoxia that develops with the above conditions may be gradual in onset and may be compatible with life for a long time, the anoxia that follows the complete cessation of respiration and circulation in cardiorespiratory arrest is rapidly destructive[1, 5, 6] to certain vital tissues, especially the brain,[7] and leads to death in a very short time.

In the human being complete cerebral anoxia for ten seconds produces unconsciousness; that for twenty to thirty seconds causes cessation of electroencephalographic brain waves; and that for three to five minutes produces irreversible pathologic change in the cerebrum.[5] The medulla with its centers can survive for twenty-five to thirty-five minutes, and the spinal centers from forty to sixty minutes.[8] The resistance of the brain in very young animals to circulatory arrest is much greater than that of the adult brain.[9] This may well be the reason why resuscitative efforts have been rewarded with success, most often in young people. Courville's monograph discloses in detail the effect of anoxia on the nervous system, particularly the brain. He found alterations in the cerebral cortex characterized by degeneration of individual cells, patchy areas of necrosis, diffuse zonal necrosis and complete cortical disintegration. Microscopic alterations in the nerve cells explained the ultimate pathological picture encountered; these were sclerotic changes, acute degeneration, ischemic alteration, pigmentary atrophy and ferrugination of nerve cells. More recently, similar studies of postmortem material have substantially corroborated Courville's findings.[7, 10] Particularly striking are the degeneration of cerebral and basal-cell ganglions, disappearance of pyramidal cells of the cerebral cortex, increase in astrocytes, proliferation of microglia and severe destruction of the occipital cortex and superior temporal gyrus.

Demonstrable pathological findings caused by anoxia in organs other than the brain are relatively meager. Damage to the myocardium by anoxia[5] is important because, although it develops less rapidly than that to the brain, it is responsible for the inability of the heart to recover from cardiorespiratory arrest in cases in which cardiac resuscitation is unsuccessful. Of all tissues, the brain is the most vulnerable and susceptible to oxygen lack.[1, 5, 6] This explains why in cases in which anoxia has advanced to the point where irreversible changes to the brain have occurred, although life is spared, permanent damage may follow. This can be the case in cardiorespiratory arrest when resuscitation saves life but is not effective enough to prevent permanent brain damage. The patient with permanent brain damage may be a vegetative organism[11] who lives on, a burden to himself and to society. In fatal cases, before death supervenes, there may be a period of coma lasting a few hours to many days.[7, 12] When life is spared beyond this time, various neurologic changes will exist.[13] Some of these will be permanent, and others will clear up completely.[14] Blindness, deafness, Parkinsonian syndrome, athetoid and choreiform movements, speech defects and emotional instability are some of the sequelae in these cases.[1]

This leads to the conclusion that the outstanding pathological result of cardiorespiratory arrest is the damage to the brain produced by anoxia.

Pathology leading to cardiorespiratory arrest. Cardiorespiratory arrest can occur when respiration and circulation fail simultaneously. Frequently, however, either respiration or circulation fails first, and the failure of the other function follows. Which of these functions fails first is immaterial,[15] for each is dependent upon the other. When respiration ceases, from whatever cause, the progressive oxygen deficiency that follows depresses the mechanism of circulation until in a few minutes circulation ceases. Conversely, any condition that results in failure of circulation[5] will very soon produce failure of respiration from anoxia. Experiments on cats in which the pulmonary artery was ligated showed that in thirty seconds blood pressure was unobtainable and in forty seconds breathing ceased; when the occlusion was relieved in less than three minutes, the animals recovered; after three minutes resuscitation was necessary; after four minutes, even with successful resuscitation, there were permanent neurologic changes.[16] By oxygenation of the blood extracorporeally, survival times were notably prolonged. It has been demonstrated that the human brain is not so capable as that of the dog of withstanding suspension of circulation and returning to normal.[17]

Respiratory arrest. The frequent causes of respiratory arrest are as follows: paralysis of the respiratory musculature — for example, that which occurs in excessive curarization[18] or in spinal anesthesia when the anesthetic level reaches the upper cervical segments[19, 20]; paralysis of the respiratory center, which may be produced by various drugs such as anesthetics,[5, 21] hypnotics and analgesics or by reflex effect such as that occurring during anesthesia when

a gross stimulus and insufficient depth of general anesthesia are present[22] (another important factor in the production of central respiratory paralysis is the anoxia that develops from respiratory obstruction[8]).

In contrast to the above types of respiratory arrest, there is a condition in which cessation of spontaneous respiration occurs without any danger to the patient. In this case, the anesthesiologist deliberately produces respiratory arrest by the "apneic technic" in which he takes over the function of pulmonary ventilation from the patient.[23] This procedure, which is readily reversible, is based on the physiologic phenomenon of eliminating carbon dioxide excessively and thus depriving the respiratory center of its physiologic stimulus. At the same time, oxygenation is not interrupted. This technic is a common practice in anesthesia.

Cardiac arrest. Circulatory failure may be of two fundamental types: cardiovascular collapse typified by shock (a discussion of this subject has been deemed beyond the scope of this review); and cardiac arrest in which the causative factors have acted upon the heart or upon autonomic centers that control heart action and have resulted in the disqualification of the heart as the motive force in circulation.

In such an event as cardiac arrest, there are two possibilities: the ventricles are fibrillating; or the heart is at a standstill. Ventricular fibrillation has been described by Guedel[24] as "a wormlike movement of the ventricular muscle with the heart in full diastole. It consists of an unsynchronized contraction and relaxation of the individual muscle fibres which provide no circulation of blood." Thompson et al.[25] described ventricular fibrillation as an "electrodynamic dissolution of the cardiac cycle."

Development of ventricular fibrillation in dogs after occlusion of the circumflex branch of the left coronary artery is characterized by the occurrence of isolated extrasystoles; this is followed by long runs of ventricular extrasystoles, and then by irregular ventricular complexes that become increasingly rapid and finally are converted to ventricular fibrillation.[26] In the operating room the common cardiac dysrhythmias observed are ventricular and auricular extrasystoles, tachycardia, foci of ectopic beats and shifting pacemaker, any one of which may be the precursor of ventricular fibrillation.[27] It has been noted that manipulations of the heart producing changes in its position or stimulation to the epicardium are prone to result in cardiac arrhythmias and that when ventricular extrasystoles or ventricular tachycardia occurs very often ventricular fibrillation follows.[28, 29] Factors of etiologic significance in ventricular fibrillation[10] include agents that sensitize the heart by their own action such as cyclopropane, chloroform and ethyl chloride[30]; hypoxia, which increases myocardial irritability and also causes an increase in epinephrine output[31]; emotional states such as fear by virtue of stimulating an outpouring of epinephrine[21]; and excessive vagal stimulation.[32]

Danielopolu and Marcou[33] pointed out that in dog and cat experiments, ventricular fibrillation is often produced by asphyxia, chloroform and manipulation of abdominal viscera. Other demonstrations have proved that ischemia of the myocardium of the dog markedly reduces the fibrillation threshold of the heart to artificial stimuli.[31] Harken and Norman[27] classify the factors that can be responsible for cardiac arrhythmias as follows: reflex mechanisms,[34] which are related to the position of the patient during operation, intratracheal, intrabronchial and intrapulmonic stimulation, chest-wall manipulation and sudden alterations in blood volume; chemical changes in the blood stream, particularly, hypoxia and toxicity or sensitivity to drugs; and direct cardiac and intracardiac manipulation producing pericardial, epicardial or myocardial stimulation, and dislocation of the heart from its position of optimum function.[28]

Stutzman and his co-workers[30] observed that ventricular fibrillation occurring under cyclopropane anesthesia is dependent upon a reflex. This reflex has its receptors in the abdominal viscera, particularly in the mesentery from which autonomic afferent pathways travel to a brain center above the pons; from there, efferent pathways lead by way of the sympathetic nervous system to the heart.

Little has appeared in the literature regarding the pathology of the condition termed cardiac standstill as compared to ventricular fibrillation. This state, which is characterized by the complete absence of activity of the myocardium,[32] "the asystolic heart,"[35] may develop suddenly owing to an overwhelming vagal reflex[32] or may develop gradually in relation to hypoxia when progressive weakening of contractions occurs. When the state of standstill is reached, the heart is in some degree of dilatation, and the irritability of the myocardium is relatively low. If the irritability of such a heart is increased, at some point the myocardium may start to fibrillate.[36] The presence of anoxia may support the change from cardiac standstill to ventricular fibrillation. For practical purposes, the heart that is not asystolic but has feeble, ineffective contractions can be considered in the same category as the heart in standstill.

Pharmacologic Action of Drugs on the Brain and Heart in Cardiorespiratory Arrest

The susceptibility or resistance of the brain to anoxia depends largely on the state of its cellular activity. The highly active brain having a high oxygen demand will suffer more from oxygen lack, whereas the brain whose function is depressed can resist anoxia to some extent.[37] Drugs that stimulate

the central nervous system will increase its oxygen demand; thus, in cardiorespiratory arrest such drugs will aggravate the danger of damage from anoxia.[38] For this reason, analeptic and sympathomimetic drugs, such as caffeine, coramine, metrazol, strychnine, ephedrine, Benzedrine, Neo-Synephrine and paredrine, which formerly were called upon in cardiorespiratory emergencies, are condemned.[5] Conversely, drugs such as anesthetics and analgesics[38] that depress the central nervous system and thereby decrease its oxygen demand may be responsible for prolonging the survival time of the brain cells during periods of anoxia.[14, 39]

Epinephrine stimulates the heart by a direct effect on the myocardium and on the conduction tissue[40, 41]; it produces more forceful contractions of the myocardium.[36] Objections raised against the use of epinephrine in cardiorespiratory arrest are based upon its ability to increase myocardial irritability,[14, 30, 42-44] to elevate markedly the oxygen consumption of the heart muscle[45] and to increase the speed of auriculoventricular conduction time. Because of these properties, when epinephine is administered in the presence of a failing heart in which a state of cardiac standstill or a prefibrillation arrhythmia exists, it may produce ventricular fibrillation. When the drug is used, Hyman[35] and Mautz[45] recommend that it be injected into the heart muscle, where it is most effective; Harken and Norman[27] recommend that it be injected into the right ventricle, whereas Dripps et al.[11] choose injection into the auricle, where it is least likely to cause ventricular fibrillation.

Procaine hydrochloride diminishes the irritability of the conduction system of the heart and of the myocardium, thereby causing reversion of prefibrillation dysrhythmias to normal rhythm.[46] Hence, it has a definite *protecting effect* on the heart against ventricular fibrillation.[42, 43, 45, 47, 48] On the other hand, although admitting that procaine raises the fibrillation threshold of the ventricles, Wiggers and Wegria[49] and Fauteux[50] believe that procaine does not prevent ventricular fibrillation. This contention is supported by a case reported by Harken and Norman[27] in which ventricular fibrillation occurred after the patient had been "procainized."

The role of procaine *in defibrillation* — that is, reversal of ventricular fibrillation — of the heart is questionable. Stutzman et al.[51] failed to control ventricular fibrillation induced by cyclopropane-epinephrine with the intravenous injection of procaine. Harken and Zoll[52] corroborated these experiences. On the other hand, a number of reports demonstrate the successful use of procaine in defibrillation of the heart.[13, 36, 44, 45, 48, 53] Procaine is recommended for intravenous administration in 1 per cent solution[48]; doses are 40 to 100 mg. in single injections up to a maximum of 200 mg.[54]

Atropine and scopolamine, by virtue of their blocking of vagal effects on the sinoauricular pacemaker, protect the heart to some extent against reflexes that may precipitate cardiorespiratory arrest.[25, 32, 55]

In addition to their main effect on the myocardium digitalis and strophanthin act upon the auriculoventricular conduction system to increase the refractory period and slow the rate of conduction.[56] The latter action protects the heart to some extent in states of increased irritability. Toxic effects from these drugs on the heart may result in arrhythmias of which ventricular tachycardia is the most serious; this may be the precursor of ventricular fibrillation.[56]

Quinidine acts upon the heart to decrease myocardial excitability and to slow conduction of impulses in the heart muscle, thereby reducing the danger of ventricular fibrillation. It has attained some favor as a preventive measure when it is given preoperatively in the presence of all cardiac arrhythmias with the exception of auricular fibrillation.[26, 27, 45, 57]

Calcium chloride and barium chloride are cardiac stimulants that increase the force of myocardial contractions.[50, 56]

Potassium relaxes the myocardium; it may produce cardiac inhibition and stop ventricular fibrillation.[56, 58, 59]

Effect of Electric Stimulation upon the Heart

When an electric current of sufficient strength is accidentally passed through the body it may cause ventricular fibrillation or cardiac standstill from inhibition of the conduction mechanism or paralysis of the myocardium.[6, 59] Experimental work has demonstrated that it is possible to apply an electric current to the heart for therapeutic purposes. Wiggers[60] introduced a method of treating ventricular fibrillation (the technic of "serial defibrillation") in which he applied a momentary shock, 1.0 ampere in strength of a 60-cycle alternating current, through two electrodes, which were placed on opposite sides of the heart. Three to seven shocks were required to stop fibrillation. He reasoned that each shock resulted in the merging of small fibrillating areas into progressively larger ones until, with the final shock, all fibrillation was arrested. At this moment, cardiac standstill was produced, and the problem of reinstituting rhythmic cardiac activity remained.

Experiences of Hooker et al.,[61] Beck and his coworkers[62] and Lampson and his associates[44] have confirmed the usefulness of this procedure in defibrillation of the heart. The equipment required is relatively simple.

Diagnosis of Cardiorespiratory Arrest

The diagnosis of respiratory arrest does not present any problem, for cessation of respiration can readily be observed. But the recognition of cardiac arrest may be quite difficult.[44] If the opera-

tive wound does not permit the inspection or palpation of the heart or a major artery, there is little reliable guide for positive diagnosis. The situation that may occur at this time is aptly described by Dripps and his colleagues[14]: "The majority of patients are doomed because minutes which cannot be spared are wasted in searching for a stethoscope, in frantic palpation of a succession of arteries, in hasty consultation with colleagues summoned to judge a situation with which they are unfamiliar."

Various diagnostic procedures such as visualization of pulsations of the retinal vessels through an ophthalmoscope,[14] inhalation of amyl nitrite to stimulate forceful contractions in a feebly beating heart,[63, 64] observation of the speed of capillary refill[14] and examination of an electrocardiographic tracing[65] are either unreliable or impractical.[14] Therefore, in the words of Dripps and his coworkers:

> Opening the thorax is the only conclusive diagnostic procedure. If the heart has stopped or the ventricles are fibrillating, minutes can be saved by adopting the attitude of rapidly opening the chest for diagnosis, whereas if the heart is beating feebly, little harm may have been done.

In cardiorespiratory arrest the clinical judgment of the anesthesiologist, who has closely observed the patient during the preceding period and who is aware of the internal and external factors that may have affected the patient's physiology, plays an important role in the evaluation of this emergency.

Prophylaxis

Undoubtedly the most important factors in the prophylaxis of cardiorespiratory arrest lie in the anesthetic management of the patient. Mousel and his associates[5] state that the intelligent and judicious handling of the patient in the preoperative period and during anesthesia will prevent most of the harmful sequelae.[10]

In the preoperative period, protective measures calculated to diminish the incidence of cardiorespiratory accidents are as follows: regulation of fluid and electrolyte balance; restriction of water and sodium intake in elderly patients and those having poor cardiorenal reserves; the proper use of digitalis and quinidine in selected cases; and the careful choice of premedicating agents that allay excitement and irritability, reduce oxygen need and inhibit parasympathetic functions.[27]

The most important preventive measure during anesthesia is the maintenance of adequate oxygenation at all times. Ruth,[66] in his studies of anesthetic accidents, found that the most common error during the period preceding the accident was that the anesthetist tolerated anoxia in his patient.

Of similar importance is the proper selection of anesthetic agents and their skillful administration. A specific preventive measure is intravenous injection of procaine or procaine applied topically to the pericardium during thoracic operations.[27] To protect the patient from ventricular fibrillation that may occur under cyclopropane anesthesia, the addition of ether to the inhaled gases is recommended. On the basis of the findings of Stutzman et al.[30] it seems likely that a spinal anesthetic administered prior to cyclopropane anesthesia has a similar protecting effect.

Finally, and by no means any less in importance, is the close co-operation between the surgeon and anesthetist that is necessary in minimizing manipulations, especially during light anesthesia, which may initiate dangerous reflexes.[28]

Treatment of Cardiorespiratory Arrest

Two aims are apparent in the treatment of cardiorespiratory arrest.

The first and immediate goal is to deliver oxygen to the tissues. Whether or not life is saved, or, if life is spared, whether or not permanent brain damage is suffered, is dependent upon the early and successful accomplishment of the foregoing principle.[1, 10, 67] The first aim is attained by simultaneously providing ventilation of the lungs by artificial respiration and artificial circulation by cardiac massage. By these procedures, oxygen is taken into the alveoli of the lungs, from which it is transported by the blood and delivered to all the body tissues. When this is accomplished, the greatest immediate danger — namely, that the cardiorespiratory arrest will become irreversible — is passed.

Artificial respiration. The fundamental principles that must be observed in artificial respiration are as follows[68]: intermittent rhythmic exchange of atmosphere in the patient's lungs must be started at the rate of sixteen to twenty times a minute; any obstruction of the throat and air passages must be relieved as quickly as possible; and adequate time must be allowed for the lungs to empty after each inflation.

Since the production of the highest possible concentration of oxygen in the alveoli of the lungs is desired, 100 per cent oxygen should be used.[10, 29] The opinion is commonly held that carbon dioxide should not be added to oxygen for resuscitative purposes because the patient whose respiration has ceased is unable to eliminate carbon dioxide retained in his blood and tissues.[5, 68] If artificial sources of oxygen are not available, atmospheric air or even the exhaled air of the operator may be used.

In the operating room, where cardiorespiratory arrest is most likely to occur, artificial respiration is best accomplished by rhythmic compression, with the force equivalent to about 20 mm. of mercury, on the breathing bag of the anesthesia machine.[69, 70] This must be promptly instituted after spontaneous respiration has ceased. If this intermittent administration of oxygen is properly ex-

ecuted and the patient does not seem to have adequate excursions of the thorax, the air passages are obstructed. It is then necessary to insert oral, nasal or tracheal airways or to remove any foreign material that may be causing the obstruction.[10] The interruption of the administration of oxygen while such manipulations take place must be for the briefest possible time. When an anesthesia machine is not available in the operating room, the same intermittent administration of oxygen may be accomplished by a simple arrangement consisting of a face mask, rubber rebreathing bag and cylinder of oxygen.[25] No operating room should function without an anesthesia machine or, at the very least, the latter equipment.

Mautz[71] has described an attachment to the anesthesia machine that utilizes compressed air as the source of the force that ventilates the lungs. Kreiselman's[72] resuscitator produces intermittent flow of oxygen under adjustable positive pressure. Other less simple apparatus that effect rhythmic inflation of the lungs followed by rhythmic suction — so-called "suck and blow" resuscitators — are recommended by Thompson et al.[25, 73, 74] and Schwerma and his co-workers.[75]

It has been pointed out that in addition to providing efficient pulmonary ventilation, the application of alternating positive and negative pressure has beneficial effects on the circulation and initiates stimulatory impulses for respiration.[73, 74, 76, 77] Disapproval of these resuscitators is based upon the possibility of damage to the lungs and the fact that unskilled application greatly reduces their usefulness and exposes the circulation to harmful effects.[78, 79] Mousel, Stubbs and Kreiselman[5] state that such apparatus should not be relied upon in these emergencies.

A recently introduced method of artificial respiration employs electric stimulation of the phrenic nerve thereby producing rhythmic contractions of the diaphragm, which will provide adequate pulmonary ventilation.[80-82] Practical considerations at present limit this promising method.

In cases where the anesthesia machine or the simple arrangement referred to above is not available in the operating room (the existence of such a deplorable situation must be condemned) methods of manual artificial respiration or mouth-to-mouth insufflation must be resorted to. Of the manual methods, the rib-retraction technic of Viswanathan[83] is regarded as superior to the method of Schafer[84] or Silvester.[85] These manual methods of artificial respiration are difficult and unsatisfactory.[5]

Artificial circulation. For re-establishing circulation several approaches are described.

Employment of an extracorporeal pump as the source of motive power in the circulation has been mentioned but is not as yet available.[16, 27, 86]

Another approach to the problem includes mechanical stimuli[25] such as needle puncture[25, 87] of the heart, percussion[25] and compression[15] of the chest wall, and incision or pinching[53] of the pericardium. Intracardiac injections of epinephrine, procaine or Neo-Synephrine,[88] or a combination of procaine and epinephrine,[10] and intravenous injections of drugs such as ether, caffeine, sodium thiosulfate, Ronzini's solution, camphor, digitalis, strophanthin, Metrazol, coramine, strychnine, 20 per cent dextrose and hypertonic saline solution have all had their proponents.[35] Beneficial results following some of these measures are reported; however, uncertainty regarding indications for and outcome of this approach is obvious.

The third approach employs the heart as the pump of the circulation, but utilizes the force from the operator's hand rather than that of the myocardium. This method of manual compression (cardiac massage) requires adequate exposure of the heart. The direct approach through the chest wall by a transverse incision in the fourth left intercostal space, with division of the fourth and fifth costal cartilages, is believed to be superior to an abdominal incision with an attempt to reach the heart through either an intact or an incised diaphragm.[2, 14, 64, 89] The heart is grasped and compressed firmly at the rate of twenty to forty times a minute, depending upon the adequacy with which the ventricles fill between compressions.[14, 27] With effective cardiac massage, the radial pulse often can be felt and the blood pressure may be as much as 60 or 70.[14] To increase blood flow through the coronary arteries and the brain, the clamping of the aorta distal to the left carotid artery may be helpful.[27] Cardiac massage is the most efficient method of providing for artificial circulation and is first choice in the technic of cardiac resuscitation.[2, 14, 27, 64, 89]

Why this is not fully appreciated is probably due to the general lack of familiarity with the technic. It is hoped that this relatively simple, life-saving surgical procedure will be included among the fundamental essentials in undergraduate and postgraduate surgical training.[15, 60]

A prearranged plan for meeting the emergency of cardiorespiratory arrest with a specific assignment for each member of the operating-room team is recommended.[64, 90]

When the first goal of resuscitation — that of oxygenation of the tissues by the administration of artificial respiration (for which the anesthesiologist with his machine is best suited) — with the simultaneous production of artificial circulation by cardiac massage (which is best performed by the surgeon[29]) has been attained, the second aim of resuscitation may be pursued without confusion and haste.

The second aim is to re-establish the vital functions — spontaneous heart action and respiration — and to attain complete recovery of the patient.

The recommended treatment when the heart has been found in ventricular fibrillation is serial defibrillation and the intravenous administration of procaine.[15, 42, 43, 62] Intracardiac injection of 10 cc. of 1 per cent potassium chloride may be helpful in defibrillating the heart.[55, 59] After defibrillation, the situation is identical with that of cardiac standstill, and effective cardiac massage is the most important measure until spontaneous rhythmic contractions are resumed.[14, 27, 29] When contractions start, they may be quite feeble. At this time, the administration of 0.5 cc. of a 1:1000 solution of epinephrine into the right ventricle[14, 27] or auricle will help strengthen the heart beat. This is perhaps the only place for administration of epinephrine in cardiac resuscitation.[27, 29, 44] The injection of 1 or 2 cc. of 0.5 per cent solution of barium chloride[26, 50, 51] or 10 cc. of 1 per cent solution of calcium chloride[26, 45] into the heart serves the same purpose.

Resumption of spontaneous respiration does not require any specific measures. If proper oxygenation of the brain has been maintained, respiration will be re-established when the respiratory center recovers from the depression incident to cardiorespiratory arrest.

In order to further the attainment of complete recovery, adjunctive therapy is desirable: continuation of inhalation therapy through a free airway and attention to maintaining an adequate urinary output by supplying sufficient fluids and electrolytes are indicated. Prophylactic measures for the prevention of pulmonary infection, hypostatic congestion and distention of the bladder are necessary.[14]

Prognosis

Dripps and his associates[14] state that, in general, if prompt diagnosis is followed by prompt therapy, the heart beat can be restarted. This thesis is supported by the studies of Kountz,[91] who examined the hearts of persons a short time after death and demonstrated that the heart is an amazingly resistant organ possessing rhythmicity and contractility that are difficult to destroy.

Factors such as the time element in instituting effective therapy, the age of the patient and the cardiac status prior to the catastrophe will ultimately determine whether the heart can be restored to normal function.[14] The anoxia that develops because of delay in diagnosis and in establishing effective artificial respiration and cardiac massage may so damage the myocardium that it resists all efforts at resuscitation. The myocardium damaged by pre-existing toxemia, arteriosclerosis, hypertension, coronary insufficiency or narcosis is much less likely to recover.[14] Wiggers[49] found that failure to recover from ventricular fibrillation depended not so much on the inability to defibrillate the heart as on the subsequent inability of the myocardium to resume vigorous beating.[50, 62]

If the heart returns to regular rhythm and blood pressure is maintained, what will be the status of the central nervous system? The prognosis is determined by the duration of cerebral anoxia.[14] Clinical experiences as well as the work of Weinberger, Gibbon and Gibbon[92] indicate that if the cardiorespiratory arrest has not exceeded two to four minutes, complete recovery may be expected. This is well illustrated by more than 70 cases reported with complete recovery.[2, 10, 12-14, 22, 41, 53, 82-84, 89, 90]

Spontaneous respiratory activity may be expected to reappear within five to thirty minutes once cardiac activity has been resumed. If cardiorespiratory arrest has been slightly more prolonged, convalescence may be stormy but may show progressive improvement with each passing hour.[14] This period is characterized by acute febrile responses, muscular rigidity, twitching, convulsions, hyperflexia and varying degrees of coma.[1, 14] The time of onset and the duration of these phenomena are prognostically significant. The persistence of coma beyond the first twelve hours is an unfavorable finding. In this case, consciousness is not likely to return, and the heart may again cease to beat within a few minutes to several weeks. If consciousness is regained, partial recovery — that in which residual neurologic symptoms persist — or complete recovery may follow.[11]

* * *

Commenting on the problem of cardiac resuscitation, Dripps and his colleagues[14] emphasize the necessity for greater awareness on the part of the anesthesiologist and surgeon of the implications of this accident. They also raise the question of approaching the problem from other points of view: What are the possibilities of protecting the brain from anoxia by preoperative measures, and what are the roles of intra-arterial and intracardiac infusions? Of what value will the oxyhemograph be in diagnosis of anoxia and prevention of cardiorespiratory arrest?[42, 92-96]

These seem to be problems for the future. The greatest problem of the present is pointed out by Mousel, Kreiselman and Stubbs who emphasize the fact that the conduction of an anesthesia expressly designed to prevent complications is of the utmost importance. They claim that the incidence of fatal accidents is more than twenty times greater in institutions where the type of anesthetic organization is poor or even average as compared to that in institutions where the best in anesthesia is available. This is understandable since the special knowledge and skill of the anesthesiologist may nowhere be more valuable than in the prevention, diagnosis and treatment of cardiorespiratory arrest.

(To be concluded)

References

1. Courville, C. B. Asphyxia as consequence of nitrous oxide anesthesia. *Medicine* **15**:129-245, 1936.
2. Nicholson, J. C. Cardiac massage. *Brit. M. J.* **1**:385-386, 1942.
3. Houston, C. S. Practical considerations of clinical oxygen lack. *New Eng. J. Med.* **240**:683-686, 1949.
4. Schmidt, C. F. Overutilization anoxia. Paper presented before the Third Postgraduate Assembly in Anesthesiology, New York, December 10, 1948.
5. Mousel, L. H., Stubbs, D., and Kreiselman, J. Anesthetic complications and their management. *Anesthesiology* **7**:69-79, 1946.
6. Flagg, P. J. *The Art of Resuscitation*. 453 pp. New York: Reinhold Publishing Corp., 1944.
7. Hawkins, J., McLaughlin, C. R., and Daniel, P. Neuronal damage from temporary cardiac arrest. *Lancet* **1**:488-492, 1946.
8. Best, C. H., and Taylor, N. B. *The Physiological Basis of Medical Practice*. Fourth edition. 1169 pp. Baltimore: Williams & Wilkins Co., 1945. P. 811.
9. Kabat, H. Greater resistance of very young animals to arrest of brain circulation. *Am. J. Physiol.* **130**:588-599, 1940.
10. Rusicka, E. R., and Nicholson, M. J. Cardiac arrest under anesthesia. *J. A. M. A.* **135**:622-628, 1947.
11. Vernon, H. K. Recovery from heart failure after cardiac massage. *Lancet* **1**:6, 1943.
12. Bohn, G. L. Artificial restoration of cardiac rhythm. *Brit. M. J.* **2**: 725, 1939.
13. Easton, A. M. Intrapartum "death" — cardiac massage — recovery. *Brit. M. J.* **1**:651, 1942.
14. Dripps, R. D., Kirby, C. K., Johnson, J., and Erb, W. H. Cardiac resuscitation. *Ann. Surg.* **127**:592-604, 1948.
15. Beck, C. S. Resuscitation for cardiac standstill and ventricular fibrillation occurring during operation. *Am. J. Surg.* **54**:273-279, 1941.
16. Gibbon, J. H., Jr. Maintenance of life during experimental occlusion of pulmonary artery followed by survival. *Surg., Gynec. & Obst.* **69**:602-614, 1939.
17. Caine, A. M. Some unusual complications of nitrous oxide-oxygen anesthesia. *Am. J. Surg.* **37** (supp.): 34-36, 1923.
18. Harroun, P., Beckert, F. E., and Hathaway, H. R. Curare and nitrous oxide anesthesia for lengthy operations. *Anesthesiology* **7**: 24-28, 1946.
19. Eversole, U. H. Some anesthetic problems. *S. Clin. North America* **18**:851-862, 1938.
20. Lium, R. Cardiac arrest after spinal anesthesia: report of case with recovery. *New Eng. J. Med.* **234**:691, 1946.
21. Milles, G., and Smith, P. W. Effects of epinephrine on heart. *Am. Heart J.* **16**:198-210, 1937.
22. Wiggin, S. C., Schultz, P. E., and Saunders, P. Experiences with curare in anesthesia. *New Eng. J. Med.* **236**:526-529, 1947.
23. Guedel, A. E. Cyclopropane anesthesia. *Anesthesiology* **1**:13-25, 1940.
24. *Idem. Inhalation Anesthesia*. Fourth edition. 172 pp. New York: Macmillan Co., 1942. P. 90.
25. Thompson, S. A., Birnbaum, G. L., and Shiner, I. S. Cardiac resuscitation, with report of case of successful resuscitation following auricular and ventricular fibrillation. *J. A. M. A.* **119**:1479-1485, 1942.
26. Smith, F. H., McEachern, C. G., and Hall, G. E. Effect of intravenous administration of quinidine sulfate on development of ventricular fibrillation following sudden occlusion of circumflex branch of left coronary artery: experimental study. *Am. Heart J.* **20**:620-626, 1940.
27. Harken, D. E., and Norman, L. R. Control of cardiac arrhythmia during surgery. Presented to the New England Society of Anesthesiology, Boston, September 14, 1948.
28. Feil, H., and Rossman, P. L. Electrocardiographic observations in cardiac surgery. *Ann. Int. Med.* **13**:402-414, 1939.
29. Beck, C. S., and Mautz, F. R. Control of heart beat by surgeon: with special reference to ventricular fibrillation occurring during operation. *Ann. Surg.* **106**:525-537, 1937.
30. Stutzman, J. W., Murphy, Q., Allen, C. R., and Meek, W. J. Further studies on production of cyclopropane-epinephrine tachycardia. *Anesthesiology* **8**:579-583, 1947.
31. Wiggers, C. J., Wegria, R., and Pevera, B. Effect of myocardial ischemia on fibrillation threshold. Mechanism of spontaneous ventricular fibrillation following coronary occlusion. *Am. J. Physiol.* **131**:309-316, 1941.
32. Adams, H. D., and Hand, L. V. Twenty minute cardiac arrest with complete recovery. *J. A. M. A.* **118**:133-135, 1942.
33. Danielopolu, D., and Marcou, I. Sur la réanimation du coeur par l'injection intra-cardiaque d'adrénaline; procédé de l'atropine-adrénaline-strophanthine-massage. *Presse méd.* **48**:44-47, 1940.
34. Burstein, C. L., Piazza, T. L., Kapp, L. A., and Rovenstine, E. A. Cardiocirculatory disturbances during intrathoracic surgery. *Surgery* **25**:36-46, 1949.
35. Hyman, A. S. Resuscitation of stopped heart by intracardiac therapy. *Arch. Int. Med.* **46**:553-568, 1930.
36. Barber, R. F., and Madden, J. L. Resuscitation of heart. *Am. J. Surg.* **64**:151-168, 1944.
37. Wiggers, J. C. Cardiac massage followed by countershock in revival of mammalian ventricles from fibrillation due to coronary occlusion. *Am. J. Physiol.* **116**:161, 1936.
38. Schmidt, C. F. Recent developments in respiratory physiology related to anesthesia. *Anesthesiology* **6**:113-123, 1945.
39. Rosenthal, O., Shenkin, H. H., and Drabkin, D. L. Oxidation of pyruvate and glucose in brain suspensions from animals subjected to irreversible hemorrhagic shock, carbon monoxide poisoning, or temporary arrest of circulation — study of effects of anoxia. *Am. J. Physiol.* **144**:334-347, 1945.
40. Mousel, L. H., and Essex, H. E. Experimental study of effects of respiratory stimulants in animals under pentothal sodium anesthesia. *Anesthesiology* **2**:272-280, May, 1941.
41. Apgar, V., and Foot, E. B. *Notes on Anesthesia*. 32 pp. New York: College of Physicians and Surgeons, Columbia University, 1943.
42. Shen, T. C. R., and Simon, M. A. Protecting action of novocaine upon chloroform-adrenalin ventricular fibrillation. *Arch. internat. de pharmacodyn. et de thérap.* **59**:68-74, 1938.
43. Hermann, H., and Jourdan, F. Cocaine et syncope adrenalino-chloroformique. *Comp. rend. Soc. de Biol.* **106**:1153, 1931.
44. Lampson, R. S., Schaeffer, W. C., and Lincoln, J. R. Acute circulatory arrest: from ventricular fibrillation for twenty-seven minutes, with complete recovery. *J. A. M. A.* **137**:1575-1578, 1948.
45. Mautz, F. R. Reduction of cardiac irritability by epicardial and systemic administration of drugs as a protection in cardiac surgery. *J. Thoracic Surg.* **5**:612-628, 1936.
46. Papper, E. M., Brodie, C. B., Lief, P. A., and Rovenstine, E. A. Studies on pharmacologic properties of procaine and di-ethyl amino-ethanol. *New York State J. Med.* **48**:1711-1714, 1948.
47. Burstein, C. L., and Marangoni, B. A. Protecting action of procaine against ventricular fibrillation induced by epinephrine during cyclopropane anesthesia. *Proc. Soc. Exper. Biol. & Med.* **63**:210-212, 1940.
48. Burstein, C. L. Treatment of acute arrhythmias during anesthesia by intravenous procaine. *Anesthesiology* **7**:113-121, 1946.
49. Wiggers, C. J., and Wegria, R. Quantitative measurement of fibrillation thresholds of mammalian ventricles with observations on effect of procaine. *Am. J. Physiol.* **131**:296-308, 1940.
50. Fauteux, M. Cardiac resuscitation. *J. Thoracic Surg.* **16**:623-639, 1947.
51. Stutzman, J. W., Allen, C. R., and Orth, O. S. Failure of procaine to reverse cyclopropane-epinephrine ventricular fibrillation. *Anesthesiology* **6**:57-60, 1945.
52. Harken, D. E., and Zoll, P. M. Foreign bodies in and in relation to thoracic blood vessels and heart. III. Indications for removal of intracardiac foreign bodies and behavior of heart during manipulation. *Am. Heart J.* **32**:1-19, 1946.
53. Touroff, A. S. W., and Adelman, M. H. Resuscitation after forty minutes of cardiac arrest. *J. A. M. A.* **139**:844-847, 1949.
54. Burstein, C. L. Utility of intravenous procaine in anesthetic management of cardiac disturbances. *Anesthesiology* **10**:133-144, 1949.
55. Burnstein, C. L., and Rovenstine, E. A. Respiratory parasympathetic action of some shorter acting barbituric acid derivatives. *J. Pharmacol. & Exper. Therap.* **63**:42-50, 1938.
56. Goodman, L., and Gilman, A. *The Pharmacological Basis of Therapeutics*. 1383 pp. New York: Macmillan Co., 1941. Pp. 504-520.
57. Zimdahl, W. T., and Fulton, F. T. Transient ventricular fibrillation; report of case with spontaneous recovery. *Am. Heart J.* **32**:117-124, 1946.
58. Wright, S. *Applied Physiology*. Seventh edition. 787 pp. New York: Oxford University Press, 1941. P. 382.
59. Hooker, D. R. Recovery of heart in electric shock. *Am. J. Physiol.* **91**:305-328, 1929.
60. Wiggers, C. J. Physiologic basis for cardiac resuscitation from ventricular fibrillation — method for serial defibrillation. *Am. Heart J.* **20**:413-422, 1940.
61. Hooker, D. R. Kouwenhoven, W. B., and Langworthy, O. R. Effect of alternating electrical currents on heart. *Am. J. Physiol.* **103**: 444-454, 1933.
62. Beck, C. S., Pritchard, W. H., and Feil, H. Ventricular fibrillation of long duration abolished by electric shock. *J. A. M. A.* **135**: 985, 1947.
63. Primrose, W. B. Cardiac resuscitation. *Brit. M. J.* **2**:540, 1935.
64. Bailey, H. Cardiac massage for impending death under anaesthesia. *Brit. M. J.* **2**:84, 1941.
65. Negovsky, V. A. Agonal states and clinical death; problems in revival of organisms; electrocardiogram during death and revival. *Am. Rev. Soviet Med.* **2**:491-499, 1945.
66. Ruth, H. S. Anesthesia study commissions. *J. A. M. A.* **127**: 514-517, 1945.
67. Eastman, N. J., Dunn, R. B., and Kreiselman, J. Relative value of pure oxygen and of carbon dioxide mixtures in experimental resuscitation. *Am. J. Obst. & Gynec.* **36**:571-579, 1938.
68. Waters, R. M. Simple methods for performing artificial respiration. *J. A. M. A.* **123**:559-561, 1943.
69. Waters, R. M. Artificial respiration by means of intermittent high pressure inflation of chest with oxygen. *Anesth. & Analg.* **15**: 10-16, 1921.
70. Thompson, S. A., and Birnbaum, G. L. Resuscitation in advanced asphyxia: role of positive and negative pressure. *Surgery* **12**: 284-293, 1942.
71. Mautz, F. R. Mechanical respirator as adjunct to closed system anesthesia. *Proc. Soc. Exper. Biol. & Med.* **42**:190-192, 1939.

72. Kreiselman, J. New resuscitation apparatus. *Anesthesiology* **4**: 608-611, 1943.
73. Thompson, S. A., Quimby, E. H., and Smith, B. C. Effect of pulmonary resuscitative procedures upon circulation as demonstrated by use of radio-active sodium. *Surg., Gynec. & Obst.* **83**: 387-391, 1946.
74. Thompson, S. A., and Birnbaum, G. L. Phenomenon of asphyxial resuscitation. Resuscitation with inert (asphyxiating) gases. *Proc. Soc. Exper. Biol. & Med.* **48**:203, 1941.
75. Schwerma, H., and Ivy, A. C. Safety of modern alternating positive and negative pressure resuscitators. *J. A. M. A.* **129**:1256-1261, 1945.
76. Thompson, S. A. Comparative values of various methods of resuscitation.
77. Birnbaum, G. L., and Thompson, S. A. Mechanism of asphyxial resuscitation: resuscitation with inert-asphyxiating-gas in advanced asphyxia. *Surg., Gynec. & Obst.* **75**:79-86, 1942.
78. Drinker, C. K. Restoration of breathing in emergencies and maintenance of respiration in non-breathing patients. *J. Oklahoma M. A.* **37**:285-293, 1944.
79. Barach, A. L. *Physiologic Therapy in Respiratory Diseases.* Second edition. 408 pp. Philadelphia: J. B. Lippincott Co., 1948. P. 238.
80. Sarnoff, S. J., Hardenbergh, E., and Whittenberger, J. L. Electrophrenic respiration. *Am. J. Physiol.* **155**:1-9, 1948. *Science* **108**: 482, 1948.
81. Whittenberger, J. L., Sarnoff, S. J., and Hardenbergh, E. Electrophrenic respiration. II. Its use in man. *J. Clin. Investigation* **28**: 124-128, 1949.
82. Sarnoff, S. J., Whittenberger, J. L., and Hardenbergh, E. Electrophrenic respiration. III. Mechanism of inhibition of spontaneous respiration. *Am. J. Physiol.* **155**:203-207, 1948.
83. Viswanathan. Cited by Barach, A. L.[79] P. 236.
84. Schafer, E. D. Relative efficiency of certain methods of performing artificial respiration in man. *Proc. Roy. Soc. Edinburgh.* Part I, **25**:39-43, 1903.
85. Silvester, H. R. New method of resuscitating still-born children, and of restoring persons apparently drowned or dead. *Brit. M. J.* pp. 576-579, 1858.
86. Iokhveds, B. I. Intracardiac blood transfusion. *Am. Rev. Soviet Med.* **3**:116-119, 1945.
87. Henderson, Y. Intracardiac therapy. *J. A. M. A.* **97**:124, 1931.
88. Harken, D. E. Personal communication.
89. Grimshaw, C. Cardiac massage: recovery. *Brit. M. J.* **1**:387, 1942.
90. MacLeod, N., and Schnipelsky, L. A. Cardiac massage for heart failure under spinal anesthesia. *Brit. M. J.* **1**:610, 1942.
91. Kountz, W. B. Revival of human hearts. *Ann. Int. Med.* **10**:330-336, 1936.
92. Weinberger, L. M., Gibbon, M. H., and Gibbon, J. H., Jr. Temporary arrest of circulation to central nervous system: physiologic effects. *Arch. Neurol. & Psychiat.* **43**:615-634, 1940.
93. Squire, J. R. Instrument for measuring quantity of blood and its degree of oxygenation in web of hand. *Clin. Sc.* **4**:331-339, 1940.
94. Hartman, F. W., Behrmann, V. G., and Chapman, F. W. Photoelectric oxyhemograph: continuous method for measuring oxygen saturation of blood. *Am. J. Clin. Path.* **18**:1-13, 1948.
95. Behrmann, V. G., and Hartman, F. W. Continuous blood O_2 saturation under pentothal N_2O-O_2 anesthesia in clinical and experimental subjects. *Federation Proc.* **6**:389, 1947.
96. Hartman, F. W. and McClure, R. D. Further anesthesia studies with photo-electric oxyhemoglobinograph. *Ann. Surg.* **112**:791-794, 1940.

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 35361

PRESENTATION OF CASE

A thirty-nine-year-old practical nurse was admitted to the hospital complaining of jaundice.

Twenty years before admission she had an attack of "acute indigestion." Her physician diagnosed a gall-bladder attack, but it subsided overnight and no operation was performed. In the subsequent two decades she had repeated attacks of similar pain. It was characterized by epigastric discomfort, "as if you had a stone and tried to push it through something and it won't go," and sometimes by an ache, radiating occasionally to both sides of the upper abdomen, to the right back and to the shoulder. The duration of the pain varied from thirty minutes to five hours. It was often more severe at night, and sometimes awakened the patient from sleep. The onset of pain was sudden. Nausea was sometimes present during attacks. There was no vomiting. The attacks occurred about once monthly, but had increased in frequency in the past several years. She went on a fat-free diet at one time without relief. Ten months before admission, she had slight malaise, "dry eyes" and a temperature of 103°F. On the following day she felt well. This phenomenon occurred every two to four weeks. There were no chills or associated abdominal pain. Eight months before admission she noted easy fatigability and weakness. One month before admission mild itching appeared at night, but it subsided in the past two weeks. Three weeks before admission jaundice, dark urine and fever appeared, and persisted. The temperature sometimes reached 103°F. There was no change in the color of the stools. She had received no blood transfusions and had had no recent exposure to others with jaundice. There was no alcoholic consumption; her appetite remained good, and food intake was unrelated to pain.

One week before admission she entered a community hospital, where the following were noted: jaundice, extreme right-upper-quadrant tenderness and a palpable and slightly tender liver edge. The serum albumin was 4.0 gm. per 100 cc., with a globulin of 2.8 gm., the prothrombin time 47 seconds (normal, 16 seconds), the blood Hinton reaction negative, the icteric index 57 per cent, the bleeding time 1½ minutes and the clotting time 5½ minutes.

The patient had never menstruated. When an appendectomy was performed several years before admission an infantile uterus was found. There had been occasional swelling around the ankles on prolonged standing.

When she was transferred to this hospital for further study physical examination showed jaun-

dice, spider-type telangiectasia on the skin, a Grade II pulmonic systolic murmur, bilateral basal inspiratory rales and a tender firm liver edge, palpable three fingerbreadths below the costal margin.

The blood pressure was 120 systolic, 80 diastolic. The temperature was 100°F. by rectum, the pulse 90, and the respirations 18.

Examination of the blood showed a white-cell count of 4000, with 51 per cent neutrophils, 40 per cent lymphocytes, 8 per cent monocytes, and 1 per cent eosinophils. The urine specific gravity was 1.015, with a ++++ test for bile, and the sediment was normal. The stools were guaiac negative and bile positive. The serum alkaline phosphatase was 9.6 units per 100 cc., the prothrombin time 28 seconds (control, 15 seconds), and the cholesterol 161 mg., and the cholesterol esters 44 mg. per 100 cc.; the serum albumin was 2.6 gm. per 100 cc., and a globulin of 3.7 gm. The nonprotein nitrogen was 24 mg. per 100 cc., and the van den Bergh reaction 11.2 mg. per 100 cc. direct, 17.4 mg. indirect. The cephalin flocculation was ++++ in twenty-four hours, the thymol turbidity ++, and the urinary urobilinogen 6.5 Ehrlich units.

A gastrointestinal series demonstrated esophageal varices. The spleen was enlarged. There was no evidence of opaque calculi in the region of the gall bladder.

In the hospital the patient's appetite was poor, and dependent edema and ascites appeared. Therapy included mercurial diuretics, intravenous injection of albumin, a high-calorie, high-carbohydrate and high-protein diet and vitamin K. Oliguria appeared and was persistent. Drowsiness and stupor followed. In the last two weeks in the hospital the temperature was irregularly elevated.

The temperature reached 104 to 105°F., where it persisted for two days, when she died, one month after admission.

Differential Diagnosis

Dr. Alfred E. Kranes: There are a number of interesting features about this problem. When I first read it, I was very much impressed by the apparent and striking discrepancy between the history and the laboratory findings. To me, the history was suggestive of disease of the extrahepatic biliary ducts, and if the pain could in any way be fitted into the terminal illness, it seemed reasonable to ascribe it to intermittent obstruction of the biliary ducts. And yet, when we come to the terminal illness, one is struck by the fact that all the laboratory findings given here point almost unequivocally to intrahepatic disease. Certainly, the presence of bile in the stools, the positive cephalin-flocculation test, the cholesterol finding and the marked urobilinogenuria point, without much question, to intrinsic disease of the liver. I have always believed that when the laboratory findings and the history are at variance, it is always better to disregard the laboratory findings and rely on the history if it is a good one. However, I do not see how it is possible to disregard the impressive array of evidence for intrahepatic disease in this case. Furthermore, we have x-ray evidence of esophageal varices, which always mean to me diffuse fibrosis of the liver. May we see these films now?

Dr. Stanley M. Wyman: The varices are well demonstrated in the lower esophagus, there being apparently several quite large, tortuous vessels. The spleen is at the upper limits of normal, if not definitely enlarged. There seems to be a compression of the superior lateral aspect of the duodenal cap, possibly from the liver or from the gall bladder. There may even be some tortuosity of the folds of the stomach over and above what one expects, to raise the question of varices in the stomach.

Dr. Kranes: I wonder if anyone has any idea how long it would take for varices to appear? Let us put it this way: In how short a time may varices appear?

Dr. Tracy B. Mallory: In a well documented case of post-necrotic cirrhosis following hepatitis that Wallgren[1] reported, the patient, a young boy, died of ruptured esophageal varices eight months after acute hepatitis.

Dr. Kranes: You certainly would not expect it to occur before several years in the usual case, would you?

Dr. Mallory: I think it could occur in a period as short as two or three years.

Dr. Myles P. Baker: Dr. Schatzki told me that four years was about the shortest time.

Dr. Kranes: It is a difficult determination to make, but it is of interest in this case.

To go back to the history for a moment, what interested me very much was how the patient with this history was able to escape more in the way of surgery or diagnostic studies over a period of twenty years. Because this history of twenty years is being compressed into a very short space, it may be that some relevant information was left out.

Dr. Mallory: I have seen doctors and nurses do just that, Dr. Kranes.

Dr. Kranes: Yes, and this patient was a nurse. She may have been an extremely stoical person and may not have consulted anyone.

It does surprise me that during twenty years no Graham test was done, and no other studies carried out. I am also intrigued by the innocent sounding statement, "When an appendectomy was performed several years before admission an infantile uterus was found." I must confess that I am more interested in what the gall bladder looked like at that operation, than in how the uterus appeared. Again, we have no information at all about that. Do we know whether the incision was made in the lower abdomen? I wonder why the operation was

done — I suppose for the attacks of pain that she had.

DR. MALLORY: It was a midline lower abdominal incision — 18 cm. long, however.

DR. KRANES: I was about to say that the surgeons may have operated expecting to find disease of the gall bladder, and, not being able to find it, they simply removed the appendix. An incision in the lower abdomen would be somewhat against that explanation. An 18-cm. incision is somewhat in favor of it. It would be helpful to know whether or not she had any abnormality of the gall bladder. Apparently, we will not find out until Dr. Mallory tells us.

So far as the terminal illness goes, I think there can be little question that this patient died of diffuse fibrosis of the liver — cirrhosis of some type. Perhaps it would be wiser simply to let it go at that. I do not believe that we can be very far wrong with such a diagnosis, but I think it is of some interest to speculate about the type of fibrosis or cirrhosis that this patient had, even at the risk of being wrong. I do not believe the terminal illness was due to infectious hepatitis — that is, it was not the type of hepatitis about which we customarily speak, a viral hepatitis. That may sound like a plausible explanation on first glance because most of the findings here are consistent with an acute hepatitis that began seven or eight weeks before death. However, there are several striking objections to it. One is the presence of varices, and the second is the presence of spider telangiectases on the skin. The latter can develop much sooner than the former, but it is highly improbable that with a seven weeks' history of the ordinary infectious or viral hepatitis either one of these would have occurred.

DR. MALLORY: Kunkel[2] has reported the detection of spider angiomas in the course of hepatitis.

DR. KRANES: How long a course?

DR. MALLORY: In a few weeks' time.

DR. KRANES: I will have to retract then, but I find it difficult to make a diagnosis of viral hepatitis in the presence of varices, unless one wants to assume that the patient had a chronic disease of the liver and finally, as a terminal event, a superimposed viral hepatitis. I would prefer to make one diagnosis to cover the whole history. Can we do that with this history? I think we can. I think this represents the type of cirrhosis or fibrosis that one occasionally finds in patients with obstruction of the large bile ducts. It travels under a variety of names. In this hospital Dr. Mallory refers to it as biliary cirrhosis. Professor Himsworth[3] calls it cholangiohepatitis, which appeals to me more. It is the type of cirrhosis that occurs with intermittent obstruction of the large bile ducts and with concomitant cholangitis. I think it is highly probable that for many years this patient had some type of obstructive lesion in the large bile ducts. This is usually due to stones, although not necessarily. It can sometimes follow an inflammatory stricture of the bile duct, and occasionally there are cases in which no obstructive lesions in the bile duct are found. I should think, however, with this history of repeated attacks of pain, that it is highly likely stones will be found, if not in the common duct, possibly in the hepatic ducts. The patient also had cholangitis as evidenced by the periodic attacks of fever, finally becoming much more marked toward the end. Occasionally these patients will have, and this patient may have had, a terminal illness, with suppuration around the small bile radicles in the liver, as evidenced by high fever and extreme tenderness of the liver. Many of these patients in more acute phases have miliary abscesses in the liver.

There would be a number of objections to such an explanation. In the first place, it is extremely unusual to develop portal obstruction in this type of cirrhosis, and we have x-ray evidence that there was portal obstruction. Another possible objection is that the white-cell count was low, or normal. Were all the white-cell counts as low as the initial one?

DR. MALLORY: We have three recorded: 4000, 5300 and 5000 — essentially normal.

DR. KRANES: It is pertinent to point out that with acute cholangitis the white-cell count often does not rise. What about the absence of jaundice? I think that is a serious objection. I would like to know whether after the attacks described there is any statement about the absence of jaundice. Apparently none was noted, but one would like to know if there were any changes in the color of the stools or urine following attacks. Here, again, it is of some interest to point out that in this type of cirrhosis we have seen a small group in which no jaundice has ever appeared and the etiology is quite obscure.

Can we consider any other type of lesion in this patient? I hardly think so, although if this patient had a diseased gall bladder for twenty years, one must mention the possibility of carcinoma of the gall bladder. I can see nothing in the record that permits one to make such a diagnosis. So, I shall end up by saying that this patient had cirrhosis of the liver and by guessing that the cirrhosis was probably of the type I have mentioned.

A PHYSICIAN: May I ask if there is any significance attached to the white-cell count of 4000?

DR. KRANES: I was unable to attach any significance to the white-cell count. The fact that there was a mild leukopenia was in favor of acute viral hepatitis. However, I find it hard to accept that diagnosis.

DR. ANDRIES QUERIDO: Although the age of the patient is much against the portal form of cirrhosis, would not the severe attacks simulating gall-bladder colic make one consider this form?

DR. KRANES: That is an interesting point and one that I should have brought out in the discussion. During the course of the ordinary portal cirrhosis, one occasionally sees patients with severe attacks of upper abdominal pain — and sometimes right-upper-quadrant pain — mimicking biliary colic in many respects, and at autopsy there appears to be no morphologic explanation.

CLINICAL DIAGNOSES

Cholemia.
Liver disease of unknown nature.

DR. KRANES'S DIAGNOSIS

Cirrhosis of liver, biliary type.

ANATOMICAL DIAGNOSES

Portal cirrhosis of liver, postnecrotic type.
Splenomegaly.

PATHOLOGICAL DISCUSSION

DR. MALLORY: The one diagnostic measure that today is usually applied to a cirrhotic patient is that of an aspiration biopsy from the liver. In this case, it was never thought safe to do it because the prothrombin time could not be brought down to normal.

The autopsy was, unfortunately, limited to examination of the peritoneal cavity so that I cannot give complete findings. However, the liver, which had been reported as three or four fingerbreadths below the costal margin, weighed only 750 mg. — barely half normal. It was shrunken, diffusely fibrotic, coarsely nodular and rather characteristic of the postnecrotic type of portal cirrhosis. The gall bladder and extrahepatic ducts were normal, with no stones and no evidence of cholangitis. Either post mortem or in the agonal period a gas-bacillus infection had developed, and there were a great many gas bubbles throughout the liver, making the histology rather poor. But still, I think, we can safely eliminate cholangitis and feel sure that it was a postnecrotic type of cirrhosis. I believe the multiple attacks of pain were of the type that one sees in portal cirrhosis that can mimic gall-bladder colic in a fashion that often leads to exploration, and nothing is found to explain it.

DR. BAKER: Do you think this started originally with acute viral hepatitis without any necrosis and went to the point of cirrhosis?

DR. MALLORY: It could have been. It would be indistinguishable from the type that we see in patients following arsenical or cinchophen therapy and so forth.

DR. KRANES: One would have to assume that these attacks of upper abdominal pain due to portal cirrhosis had been present for twenty years.

DR. MALLORY: I think that is possible. It was an old, inactive process. The spleen was estimated as weighing 900 gm. — markedly enlarged.

DR. KRANES: How about the attacks of fever? They are not very well explained.

DR. MALLORY: There is no adequate explanation. But, as I say, we did not have a complete autopsy. We might have found something in another part of the body to account for it. I do not believe that this gas-bacillus infection could have existed for more than a few hours before death.

REFERENCES

1. Wallgren, A. Erfahrungen über epidemischen Icterus (sog. Icterus catarrhalis). *Acta pædiat.* 9:1-90, 1930. Supp. 2.
2. Kunkel, H. G., and Hoagland, C. L. Observations on family epidemic of infectious hepatitis. *New Eng. J. Med.* 236:891-897, 1947.
3. Himsworth, H. P. *The Liver and Its Diseases.* 204 pp. Cambridge: Harvard University Press, 1947. P. 169.

CASE 35362

PRESENTATION OF CASE

A fifty-one-year-old painter was admitted to the hospital because of vomiting and gnawing epigastric pain.

The present illness dated back some twenty-five years before, when he first noticed the onset of gnawing epigastric pain, occasional vomiting and "indigestion" relieved by sodium bicarbonate. X-ray examination at that time revealed a peptic ulcer. On therapy, consisting largely of diet, the patient became asymptomatic rather rapidly. One year later he discontinued his diet and since that time had intermittent recurrence of mild to moderate distress. Two years before admission he noticed the onset of occasional vomiting. Following a gastrointestinal series taken a few months later, he was told that there was some obstruction at the site of the old ulcer. During the two months before entry to the hospital he had increasing difficulty retaining food and vomited frequently. He lost about 16 pounds of weight during this period. At no time had there been hematemesis or melena. A review of the systems revealed that the patient had had frequency and mild burning on urination during the recurrences of the gastrointestinal symptoms. He had nocturia every two hours during the two-month episode that brought him to the hospital. He had noted no hematuria, chills, fever or costovertebral-angle tenderness.

Physical examination revealed a well nourished, well developed man in no apparent distress. The chest was clear; the heart was normal. The abdomen showed only hyperperistalsis.

The temperature, pulse and respirations were normal. The blood pressure was 120 systolic, 80 diastolic.

Examination of the blood disclosed a nonprotein nitrogen of 39 mg. and a total protein of 6.6 gm. per 100 cc. The blood chloride was 98 milliequiv. per liter. The phenolsulfonphthalein test showed 33 per cent excretion of the dye in two hours. The blood hemoglobin was 12.9 gm. The white-cell

count was 6800. The urine showed a specific gravity of 1.015 and was normal.

A roentgenogram of the chest revealed some evidence of emphysema and fibrosis. A gastrointestinal series showed a severe, constricting deformity of the duodenal cap within which an ulcer crater could be seen. An intravenous pyelogram disclosed slight blunting and rounding of the calyxes on the right as well as slight dilatation of the pelvis.

Cystoscopy performed six days after admission demonstrated normal bladder mucosa except for many small pieces of fibrin. Both ureters were easily viewed. The right ureter discharged small pieces of fibrin. The retrograde pyelogram showed some pelvic sacculation, but the calyxes appeared sharp. After the cystoscope had been passed a large amount of cloudy urine was obtained, especially in the final dregs. A culture taken at the time of cystoscopy was later reported as showing no growth.

After cystoscopy the patient was noted to have difficulty in voiding. This symptom persisted. On the second day following cystoscopy he was given 2 gm. of sodium sulfadiazine in 1500 cc. of 10 per cent dextrose and water. On the next day a closed bladder drainage was established. The phenolsulfonphthalein test at this time showed 18 per cent excretion of the dye in fifteen minutes and 50 per cent excretion at the end of two hours. On the following day he was found to have a temperature of 103°F. (it had previously been normal). Examination of the urine revealed a + + + test for albumin, and the sediment contained 40 to 60 white blood cells and 20 to 30 red blood cells per high-power field. A urine smear showed scattered gram-negative rods and abundant colon bacilli. The white-cell count was 11,000. The nonprotein nitrogen was 29 mg. per 100 cc. The daily dose of 2 gm. of sulfadiazine had been continued, and twenty-four hours later the temperature was normal and remained there. Three days later a subtotal gastrectomy was performed. His postoperative condition was considered good. A subsequent pathological report disclosed a healing duodenal ulcer.

On the third postoperative day the urine was loaded with white blood cells, and a culture was positive for *Bacillus pyocyaneus* (*Pseudomonas aeruginosa*). The temperature was normal, however. The nonprotein nitrogen was 26 mg., and the total protein 5.9 gm. per 100 cc., and the chloride 98 milliequiv. per liter. He was continued on 2.5 gm. of sodium sulfadiazine daily. Ten days after operation he was ambulatory, and he was taking a six-meal bland diet without difficulty. A blood sulfadiazine level was found to be 12.5 mg. per 100 cc., after which the dose was reduced to 0.5 gm. daily. On the following day, after a severe chill, the temperature rose to 103°F. He had difficulty voiding and complained of slight burning. There was no costovertebral-angle tenderness. The urine was loaded with white blood cells and bacteria. A gastrointestinal series showed some delay in the passage of barium at the gastric cardia. He was started on penicillin and streptomycin. During the next twenty hours the urinary output was about 250 cc. The temperature had remained at 103°F., and the white-cell count was 19,200. At this time the patient appeared very toxic. His face was flushed, and there was mottled cyanosis of the skin of the trunk and extremities. Respirations were rapid, and the pulse was 110. The blood pressure was 68 systolic, 40 diastolic. There seemed to be some spasm and tenderness in the right upper quadrant. The abdomen had a doughy feeling. Slight right-costovertebral-angle tenderness was also noted. An abdominal paracentesis later the same day produced only 5 cc. of cloudy, nonodorous fluid. A smear showed many white cells. A culture was later reported to have grown nonhemolytic streptococcus and a questionable beta-hemolytic streptococcus. In an eleven-hour period following this the urinary output was about 30 cc. Examination revealed a + + + + test for albumin, and the sediment contained countless white blood cells and red blood cells, but no crystals. (The urine became grossly bloody.) Study of the blood disclosed a nonprotein nitrogen of 67 mg. and a total protein of 4.7 gm. per 100 cc., a chloride of 83 milliequiv. and a carbon dioxide of 14.6 milliequiv. per liter and an amylase of 31 units and a sulfadiazine level of 8 mg. per 100 cc.

In an effort to restore the electrolyte balance he was given hypertonic saline solution following which his condition seemed to improve. However, later the same day he complained of episodes of severe abdominal pain, recurrent in nature, with pain-free periods in between. The abdomen was rigid, silent and tender. The white-cell count was 15,400, and the temperature 101°F. A blood culture was later reported as positive for *B. pyocyaneus*.

On the following day he seemed considerably improved although he remained oliguric. The abdomen

remained rigid, especially in the right upper quadrant. The blood sodium had risen to 128 milliequiv. per liter.

An operation was performed.

Differential Diagnosis

Dr. Francis D. Moore*: I should like to know what the rectal examination showed with reference to the prostate and also what the urinary sediment showed.

Dr. Tracy B. Mallory: The prostate was not enlarged or tender. Examination of the urinary sediment on admission was negative. That is the only comment we have — just negative.

Dr. Moore: This case is important from the point of view of time relations. I should like to review them before going into the details of the history. The patient apparently entered the hospital with a past history of both urinary and gastrointestinal symptoms. The urine culture was negative despite the gross urinary sediment found on cystoscopy, so we must assume that that was a laboratory error and that the patient's urine was not normal. When the cystoscope was first put in there was fibrin which is seen in the urine in cystitis and is accompanied by a high white-cell count in the sediment. Cystoscopy was done on the sixth day, and on the twelfth day a subtotal gastrectomy was carried out. Following that he had ten days of uneventful convalescence except for continuation of the urinary-tract infection. That is important because a patient who has had ten days of smooth convalescence after subtotal gastrectomy should rightfully be considered to be beyond the point where one could expect a blow-out either of the duodenal stump or of the other suture lines. Yet this time is too short for the development of a jejunal ulcer; so the interval is of some help to us. On the eleventh postoperative day things began to pile up. The x-ray examination showed delay at the gastric cardia; spasm and tenderness of the abdomen on the twelfth day; severe abdominal pain on the thirteenth day; and a distended abdomen on the fourteenth day.

As I see it there are two problems in this case. One is the nature of the renal lesion; the second is the nature of the intra-abdominal complications of the gastrectomy. He was fifty-one and a painter. When Dr. Aub looked at the protocol, he immediately assumed that this was the case he was to discuss. The question of lead poisoning must be considered as a possibility in the background.

His illness began at twenty-six, which is the characteristic age for the onset of duodenal ulcer symptoms. X-ray studies revealed a duodenal ulcer at that time. I assume that the treatment of duodenal ulcer twenty-six years ago — as at present — consisted largely of diet. The patient became asymptomatic rapidly, again characteristic of duodenal ulcer in the young adult male. One year later he discontinued his diet, and since that time he had had intermittent recurrence of mild to moderate distress. It would be interesting and important to know what he did when his distress came back. Did he treat himself with alkali? Here is a patient with severe kidney disease: we wonder if he took calcium in the form of milk or powders, or did he just avoid rich foods?

Twenty-four years later, he began to have obstructive symptoms. He was admitted to the hospital with genuine obstruction — I say "genuine" since he lost 10 pounds in weight. This history is quite consistent in itself with the history of duodenal ulcer, and I see no reason to doubt that diagnosis or to take any further time discussing it. The report was "healing duodenal ulcer." This is interesting because it suggests a little difficulty for the surgeon in doing a gastrectomy, which is significant when we later pause to consider possible complications.

Did the patient have pyelonephritis or tuberculosis of the urinary tract? Restricted fluid intake, alkali therapy and exacerbation of urinary-tract infection are all factors that might have correlated a flare-up of renal disease with a flare-up of his ulcer symptoms. Frequency, burning and nocturia all point to the bladder and were certainly marked features of his symptomatology previous to admission. Whether he had chronic Bright's disease or pyelonephritis secondary to intravesicular obstruction we do not know from the evidence. When he came in, vital signs were normal, and the chemical studies were essentially normal, but he had a low phenolsulfonphthalein excretion — it was 33 per cent in two hours. So this man's many years of renal difficulty had left him with definite impairment of renal function. The specific gravity of 1.015 is of possible interest — since he came in with vomiting and was mildly dehydrated. What was the red-cell count?

*Surgeon-in-chief, Peter Bent Brigham Hospital.

DR. MALLORY: No red-cell count is given.

DR. MOORE: The total protein was 6.6 gm. per 100 cc. — suggestive of dehydration in a thin, depleted man. He should have been able to concentrate better than 1.015.

Let us have a look at all three sets of x-ray films at one time.

DR. STANLEY M. WYMAN: The films of the chest show no demonstrable gross abnormality. One film taken from the intravenous-pyelogram examination is poor because of the large amount of overlying gas in the large bowel. However, one can see that at fifteen minutes the contrast substance appeared in good concentration in both kidney pelves and calyxes. Other films taken at this examination are less satisfactory. The pelvis of the right kidney is definitely somewhat wide, and the major calyxes are wide. The minor calyxes are not adequately seen, but I can demonstrate no gross blunting or lack of cupping. It is interesting that the bladder shadow is distended at this time, and as yet no dye has appeared in the bladder. The retrograde pyelogram done four days later again shows the rather large bladder, which may be a result of cystoscopy. I believe the pelves and major calyxes are slightly widened on the right and perhaps even a little on the left.

DR. MOORE: Would you describe the kidney findings as compatible with a diagnosis of tuberculosis of the upper urinary tract?

DR. WYMAN: I do not think the evidence for tuberculosis is here unless it is in one minor calyx at the lower pole of the right kidney, which shows a narrow band of constriction. I can see this on no other film. It may be a chance result of muscle contraction at this time. I would hesitate to make a diagnosis of tuberculosis on the films available.

DR. MOORE: The course of the ureter does not seem abnormal?

DR. WYMAN: The course is normal; the ureter is a little bit wide. It is interesting that with withdrawal of the catheter from the left kidney there was a suggestion of blunting in the lower pole, which raises the question of an aberrant vessel or possibly, and less likely, a stricture. The gastrointestinal series before operation demonstrates the duodenal cap with a crater. The film taken after subtotal gastrectomy shows the gastric remnant and anastomosis of the jejunum.

DR. MOORE: What about the cystoscopy? I have already brought out that we cannot blame the urinary disease on cystoscopy. It antedated it since small pieces of fibrin were coming out of the right ureter. All that means is that the inflammatory process was above the bladder.

Then we move on to the institution of sulfadiazine therapy, which comes along through the rest of the history. There are two or three things of interest about it. Here is a patient with kidney disease (although at the time it was not certain how serious a factor it was going to become) who was given a drug that in the presence of oliguria might well have precipitated in the kidney. We should like to know if there were any casts in the sediment. Yet the nonprotein nitrogen stayed down, and the sulfadiazine was continued. I can well imagine the thoughts on the Surgical Service: Should they go ahead or wait? He was not taking oral feeding. Parenteral alimentation could not replace oral feeding indefinitely, and the surgeon probably wanted to get him over to oral intake. The temptation to open his alimentary canal was overwhelming, and despite the risk of gastrectomy they decided to go ahead with operation.

At first the patient did well. The temperature was normal. "He was continued with 2.5 gm. of sulfadiazine." Was that by mouth or by vein?

DR. JOHN B. STANBURY: Both.

DR. MOORE: That is important. In a patient given sulfadiazine orally, after subtotal gastrectomy one cannot be confident of the degree of absorption in the postoperative period. But if the drug is given by vein, it gets into the body fluids and, therefore, is capable of producing difficulty in the kidneys. It is interesting that ten days after operation he was up and around, getting 2.5 gm. a day; 2.5 gm. is not a large dose, but the blood sulfadiazine level was 12.5 mg. per 100 cc. That must have disturbed the Service, since he was not excreting the drug properly even with a small dose. Whereupon the temperature went up, apparently because of urinary difficulty. The urine sediment continued to be loaded with white cells and bacteria. A gastrointestinal series was taken and he was started on penicillin and streptomycin. This is interesting because this combined therapy is capable of masking a great deal that is going on in the abdomen. The urinary output was only 250 cc., approximately a fifth of what the Service would have liked it to

be. The blood sulfadiazine level was 12.5 mg. per 100 cc., and along with 250 cc. of urine a day there is no question that he was running a real risk of precipitation of this drug in the kidneys. The patient began to look toxic, and the blood pressure dropped. A flushed face and a high temperature may be due to kidney disease, but the mottled cyanosis and the blood-pressure drop are, in my experience, less commonly associated with an exacerbation of pyelonephritis. There seems to have been spasm in the right upper quadrant — something beginning to develop in the abdomen — despite the fact that it was twelve days after operation. Then toxemia developed, and there was a doughy feeling in the abdomen, and some distention — a characteristic finding in tuberculous peritonitis. The abdominal tap yielded only 5 cc. of white, malodorous fluid. I wondered why they used the word "only." I would put an exclamation mark after this because it is difficult to obtain much fluid by tap. Usually with localization it is walled off; it is difficult to get much material by aspiration of a peritonitis.

Then the urinary output dropped even more — 30 cc. in eleven hours. The urine became grossly bloody for the first time, and the blood chemical findings markedly abnormal. The nonprotein nitrogen was 67 mg. per 100 cc., and the total protein dropped to levels that in the laboratories of this hospital are definitely compatible with an accumulation of edema. The chloride was 83 milliequiv., and the carbon dioxide 14.6 milliequiv. per liter — in other words, total anions were depressed, with definite acidosis. I would just assume that the sodium was also very low. What was the sodium?

Dr. Stanbury: About 115 milliequiv. per liter.

Dr. Moore: The sulfadiazine level got down to 8.0 mg. per 100 cc. after the dose had been reduced to 0.5 gm. Did he have sulfonamide crystals in the urine? An effort was made to restore the chloride with saline solution. The situation was ripe for such therapy: plasma chloride is responsive to the use of hypertonic solutions. He developed more pain, recurring at intervals and suggesting smooth-muscle cramps. The blood culture was positive for *B. pyocyaneus*. I do not know how to interpret that; I doubt if it was the organism in his blood. The change from 115 to 128 milliequiv. per liter in the blood sodium was due presumably to the concentrated saline solution.

Were the oliguria and anuria due to pyelonephritis from an ascending infection? Ulcer patients form stones and pass them from time to time, and this might have been the background. As a matter of fact, 4 or 5 per cent of patients who come to surgery for duodenal ulcer will have a history of having passed renal stones. This patient did not, but that would be a logical background for pyelonephritis in this case. As far as the abdomen is concerned, the most likely bet is that he developed an abscess around the duodenal stump. This development was masked by sulfonamide, penicillin and streptomycin therapy. Toward the end of the history the abscess got larger, and we might hypothecate that it ruptured into the general peritoneal cavity — general peritonitis and obstruction. A great many things are against that: duodenal-stump difficulty after ten days of apparently uneventful convalescence is rare. That brings it up to the second possibility, that he did not have peritonitis but that the malodorous abdominal fluid was a case of mistaken identity. The needle might have got into some viscus, possibly the bladder. His signs and symptoms may have been due entirely to renal disease. Ileus, cramps and distention can be seen not only in renal colic but also in kidney failure. The third possibility is that the abdominal picture and the renal disease were both on the same basis, and the only way I can tie them together is by the diagnosis of tuberculosis. If this patient had renal tuberculosis, we might assign it as the cause of the urinary symptoms and suggest that after a subtotal gastrectomy, for some reason, he developed tuberculous peritonitis.

We have three sets of diagnoses, and which shall I take? The safest bet is to take the commonest, although that is not the most intriguing possibility, and say that he had pyelonephritis, with renal failure, probably on the basis of stones, possibly made worse by the precipitation of sulfonamide in the kidney, and to account for the abdominal symptoms, a leak at the duodenal stump with the development of an abscess. Having taken what I think is the best bet, I shall hand Dr. Mallory an apple.

Dr. Stanbury: I saw this man two days before operation. At that time the problem as outlined was mainly one of renal failure, sepsis and disturbed electrolyte balance.

DR. MOORE: Two days before the final operation?

DR. STANBURY: Yes. From the chart, as we saw it, it seemed obscure. About forty-eight hours before the final operation, he really began to get into trouble. He was up and about during that time, and we have no way of knowing whether the sulfonamide was being precipitated.

DR. MOORE: Do you see renal difficulty due to precipitation of sulfonamides in the kidney tubules without any crystals coming down into the urine?

DR. STANBURY: Usually we see the crystals.

DR. MOORE: Lower-nephron nephrosis after transfusion without hemoglobinuria?

DR. MALLORY: I would say almost certainly no to both questions.

DR. ALLAN M. BUTLER: Sulfonamide reaction can occur in the absence of crystals in the urine.

DR. STANBURY: We were concerned with the electrolyte balance. Dr. Jack Crawford helped us on that. The patient was moribund, and Dr. Crawford brewed us a solution of hypertonic saline and lactate, which was given every two hours with dramatic improvement. The cyanosis disappeared, the respirations improved, and the patient looked better.

DR. MOORE: Did the renal output improve after the hypertonic infusion?

DR. STANBURY: Not appreciably.

DR. BUTLER: Did the blood pressure improve?

DR. STANBURY: Yes. We thought along with the surgeons that he had sepsis in the right upper quadrant.

CLINICAL DIAGNOSES

Pyelonephritis, *B. pyocyaneus*.

Peritonitis, acute.

Septicemia, *B. pyocyaneus*.

DR. MOORE'S DIAGNOSES

Pyelonephritis with renal failure, caused by renal stones and possibly sulfonamide nephrosis.

Abdominal abscess at site of gastrectomy.

ANATOMICAL DIAGNOSES

Pyelonephritis, severe, B. pyocyaneus.

Operation: subtotal gastric resection for duodenal ulcer.

PATHOLOGICAL DISCUSSION

DR. MALLORY: At the time of exploration no gross peritonitis could be found and no evidence of any localized sepsis. The patient died shortly after operation.

DR. MOORE: Did he have anything at that exploration to correlate with the 5 cc. of purulent fluid?

DR. MALLORY: A small amount of slightly cloudy fluid was found, nothing else. At autopsy our findings were similar. The peritoneum contained a slight amount of fluid, a little old fibrin and no evidence of acute peritoneal reaction and no localized sepsis. The stomach and the resection lines in the stump of the duodenum were perfectly adequate. Our only important finding at autopsy was in the kidneys, which showed extremely severe, extensive pyelonephritis. Cultures from them showed a pure culture of *B. pyocyaneus*. I think the finding of *B. pyocyaneus* in the blood stream ante mortem was unquestionably due to septicemia. It is an organism of low virulence and on frequent occasions has been observed to go with septicemia. We did not find any other organisms in the kidneys. It was not possible, in the face of severe, acute reaction in the kidneys, to say with any definiteness whether there was long-standing pre-existing pyelonephritis. Everything was obscured by the intense reaction, and the renal substance consisted almost entirely of a mass of focal abscesses. There were a few old calcium spicules scattered here and there in the renal parenchyma, which probably went back to the alkali therapy.

DR. MOORE: It might be worth while to say that the hunch, that the ten-day period of convalescence really did have significance, was correct. I think that is an important point.

DR. MALLORY: Yes.

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"LEARNED ART AND PUBLIC SERVICE"

ROSCOE POUND, in his address delivered at the annual dinner of the Massachusetts Medical Society in May and published as the leading article in this issue of the *Journal*, describes clearly the position of the professions in the society of today.

Popular ideas of a profession are somewhat confused by the modern meaning of professionalism in its relation to athletics. Preferable to the concept of professional as used in apposition to amateur is that of a profession consisting of "a group of men pursuing a common calling as a learned art and as a public service."

A heritage of the Middle Ages, this pattern is the one in which medicine, the law, the ministry and teaching have developed and achieved their stature. Other important callings have come in recent years to be considered among the professions, being of much the same substance, "as learned arts, taught in universities and pursued in a tradition of learning." Such are journalism, engineering, business administration, social work and public administration.

For many the idea of ethics helps to distinguish the profession, since ethics is implicit in its pursuit — not that a trade cannot and should not be ethically conducted, but its primary object is commercial. Three ideas, according to Dean Pound, are essential in a profession: organization, learning and the spirit of public service — to which he later adds a code of ethics. The earning of a living in a profession does not detract from its concept but may be curbed by the professional spirit.

This also is implicit in professional organization, that professional societies and associations exist only for the purpose of protecting and improving the standards of service, not for the benefit of the persons practicing the profession. If benefit accrues to the practicing personnel it follows naturally on an improvement in the quality and the conditions of the practice.

In America, Dean Pound points out, the pioneer forefathers distrusted specialists in any line and put their faith in the versatility that had been so essential to their own success. This was to the detriment of the professions. Deprofessionalization was part of the creed of the frontier, which has made necessary a reprofessionalization during the last two generations.

The world moves on. As American political thought breaks away from its fear of governmental oppression of the individual, new pressures are appearing. From four sources in today's society the professional ideal is being threatened. These are the exigencies of the individual economic existence, which is always present; the increase in detail in every branch of learning, leading of necessity to partnerships and groupings; the pressure of business methods; and eventually the advent of the service state and "the growing tendency to rely on official rather than on individual private initiative and to commit all things to bureaus of politically organized society."

Here is the great menace to the professional ideal — "the development of great government bureaus and a movement to take over the arts prac-

ticed by the professions and make of them functions of the government to be exercised by its bureaus in a super-service state that may become a service super-state." It is not the idea of the service state that is repugnant, for welfare services that ameliorate the lot of many persons must continue. It is the difficulty of maintaining a balance between individual initiative and regimented co-operation. Majority dictation must not be reverenced.

"The service state," Dean Pound is willing to concede, "is a political step forward. But we must not let it turn back upon itself and lead us to absolutism. There is no surer road to absolutism than an unchecked omnicompetent bureaucracy."

Freedom is not a natural state for man, which rushes in wherever a political vacuum exists. It must be fought for, cherished and guarded, against threats from within as well as from without. It is based on tolerance, which is one of the rarest social and political attributes. Nowhere has true democracy, now in jeopardy, been more subtly defined than in a quotation from the essayist, E. B. White, published in the *Harvard Alumni Bulletin*.

"Democracy," according to this definition, "is the recurrent suspicion that more than half of the people are right more than half of the time."

HEALTH UNIT BILL BECOMES LAW

THE Union Health Bill, enabling all towns and cities of Massachusetts to form union health departments, was signed by Governor Dever on August 10. Such combinations at a community level actually add strength to decentralization in government, long a New England tradition but unique in present political procedures.

The Commonwealth of Massachusetts entered early the field of public health with the establishment of the first board of health in Boston in 1799. Seventy years later the first state department of health in the country was established in Massachusetts, a delayed result of Lemuel Shattuck's famous survey. This early entry into the field gave rise, however, to the acceptance of methods and traditions that, though outworn, have survived to the present day. Systems of organization that were suited to the relative isolation of communities and the slow rate of travel of another century are not adapted to cope with the increased populations and the mobility of today.

Under the circumstances that at present prevail, each of the 351 cities and towns of the Commonwealth has its own board of health, with no health officer at all in 113. Only a few communities have joined forces in providing a better grade of public-health services for themselves, as has been done through the Nashoba Health Unit. The new law, called by Dr. Vlado A. Getting, commissioner of public health of Massachusetts, "the most important health legislation that has been passed since the establishment of our State Department of Health in 1869," removes the barriers that have prevented the people of Massachusetts from having all the available advantages of public-health protection.

The Act makes possible the formation generally of units such as that which exists in the Nashoba area, headed by full-time medical directors chosen by the union boards of health. The need was emphasized in the 1948 Recess Commission Report to the Massachusetts General Court, which recommended full-time union health departments for each 35,000 population group in the State.

Through these units the advantages of immunization of pre-school children, pre-natal advice to mothers, well-child conferences, inspection of private water supply and sewage systems, chest x-ray examination and the control of communicable disease can be brought to the people of the Commonwealth wherever they may live.

Through better health services for all the people will come one of their best defenses against the extension of sickness taxation at any level.

DEFEAT OF PLAN 1

THE rejection by the United States Senate last month of Reorganization Plan 1, the proposal for an all-inclusive department of welfare, has resulted in considerable lamentation and some recrimination from friends and foes of the Administration alike. The most serious criticism of the Senate vote and the most apparently logical one appears to be that the rejection of this initial fractional reorganization plan represents a potential rejection of the Hoover

Report in its entirety — that a wedge has been driven in that will split the recommendations of the Commission from stem to stern.

Such an interpretation, however, need not be given major consideration. The Commission itself was by no means emphatically in favor of the department of welfare and gave at least partial support to the idea of a separate department of health. The argument of the proponents of the plan, that the Administration's proposals should have been accepted at the time and corrected later, if necessary, by the separation of the department into those units that would function best independently of each other, presented a species of reasoning that scarcely needed to be taken seriously. Eggs are not thus easily unscrambled, nor can an ambitious department head, should such a one be chosen, be expected to give up any part of his authority without a struggle.

A POOR SHOWING

In the Massachusetts Medical Society section of this issue of the *Journal* a statement appears from Dr. George F. Lull, secretary of the American Medical Association, regarding the twenty-five-dollar assessment that was levied upon the members last winter. The Massachusetts Medical Society, with only 49 per cent of its own membership responding, stands in forty-second place among the fifty-three constituent associations that make up the parent organization.

There are various reasons for this absolute and relative delinquency. A number of the fellows of the Society are financially unable to meet the assessment, and no pressure is being put upon them to pay. The Society does not ask any fellow to assume an undue burden on this account. With many, however, it is believed to be a matter of principle, real or apparent, that although they are opposed to compulsory federal health insurance, they are even more opposed to the methods of the American Medical Association in combating it and will have no part in such an undertaking.

These physicians are urged to see the problem as a whole, one in which they are all involved, and one in which minor grievances and criticisms of methods should not stand in the way of the larger principles at stake. Such a plea is not directed to those few doctors who are honestly and earnestly in favor of compulsion. Their principles are respected as all honest principles should be. Otherwise the situation appears to be one in which an association of physicians, in need of funds, levies an assessment on its membership, as provided in its by-laws. Approximately half the members from one state, still retaining their membership, neglect to pay.

There are times when Massachusetts may well be proud to stand with a courageous minority instead of with a mistaken majority. Is there any evidence that this is one of them?

A physician from Westchester, N. Y., has established himself on the banks of the Sacramento, in a log cabin, one-half of which he uses as a store and the other as a hospital; and it is said that he receives as much gold daily as the average of twenty miners.

Boston M. & S. J., *September 5, 1849*

MASSACHUSETTS MEDICAL SOCIETY

A. M. A. ASSESSMENT

On August 2, 1949, the following statement was received from Dr. George F. Lull, secretary of the American Medical Association.

> As of July 28, 1949 our records show that your association had remitted 49% of the twenty-five dollar assessment. Its relative standing in percent collected among the 53 constituent societies is 42.

There are fellows of this society who, for one reason or another, cannot meet this assessment, but if we are not to appear in such a dismal light, surely 80 per cent of our membership should meet the obligation.

Recently the district secretaries have been given the lists of fellows in their districts who have not yet paid this contribution to the Educational Campaign.

It is hoped that personal contacts in the various districts will bring the desired result.

DEATHS

Boos — William F. Boos, M.D., of Fall River, died on August 11. He was in his eightieth year.

Dr. Boos received his degree from Harvard Medical School in 1901. He was medicolegal expert for the federal Government and the Commonwealth of Massachusetts and for many years was toxicologist for the Suffolk County medical examiner. He was a fellow of the American Medical Association.

His widow and two daughters survive.

Dunn — William A. Dunn, M.D., of Boston, died on July 15. He was in his eighty-first year.

Dr. Dunn received his degree from New York University Medical College in 1893. He was formerly police surgeon and physician at the Boston prison and House of Detention. For twenty-five years he served as assistant to the medical examiner of Suffolk County.

Emery — William C. Emery, M.D., of Dorchester, died on August 20. He was in his seventy-sixth year.

Dr. Emery received his degree from Harvard Medical School in 1909. He was a fellow of the American Medical Association.

His widow and two sons survive.

Reagh — Arthur L. Reagh, M.D., of West Roxbury, died on June 15. He was in his seventy-ninth year.

Dr. Reagh received his degree from Harvard Medical School in 1898.

Robinson — Henry A. Robinson, M.D., of Hingham, died on August 21. He was in his sixty-third year.

Dr. Robinson received his degree from Harvard Medical School in 1911. He was a member of the New England Pediatric Society.

His widow, a daughter, his father and a brother survive.

Story — Theodore L. Story, M.D., of Southbridge, died August 9. He was in his sixty-second year.

Dr. Story received his degree from Tufts College Medical School in 1917. He was a fellow of the American Medical Association.

His widow, a brother and two grandchildren survive.

Tierney — Thomas F. Tierney, M.D., of Hudson, died July 24. He was in his seventy-third year.

Dr. Tierney received his degree from Baltimore Medical College in 1901. He was a fellow of the American Medical Association.

Two sons, a daughter and a brother survive.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

NITRITE POISONING IN INFANTS

From various places in the country come reports of acute illnesses, mostly in young children or infants, that have been traced to drinking of waters high in nitrates. The illness is marked by a blue color of the skin with rapid recovery when the source of water is changed. Unless properly diagnosed and treated, however, the disease is by no means to be lightly regarded. Some reports indicate a mortality of 10 per cent.

The apparent explanation for the difficulty lies in the young infant's inability to break down satisfactorily the nitrates into ammonia. The resultant nitrites combine with hemoglobin to form methemoglobin.

Arthur D. Weston, C.E., director of the Division of Sanitary Engineering, Massachusetts Department of Public Health, has investigated Massachusetts waters and reports that in recent years the highest yearly average nitrate content of any public water supply in the Commonwealth has in only one case exceeded 10 parts per million, a concentration believed to be the upper limit of safety. This was exceeded by the semi-public supply of Whately (Craft Springs) in 1943, 1944 and 1945, when it was found to be 17.1, 20.8 and 13.0 parts in a million, respectively.

Considerably higher nitrate content has been reported, however, in this state in waters of rural water supplies such as the "farm well."

No cases of methemoglobinemia have been reported thus far to the Department of Public Health as chargeable to water supplies in this state. Precise information is needed to disclose the minimum concentration of nitrates in waters that have actually caused cases of methemoglobinemia among infants.

The Massachusetts Department of Public Health would welcome notification by physicians of any cases of methemoglobinemia. The Department will arrange for examination and analysis of water used in connection with the feeding of these infants.

PREVALENCE OF COMMUNICABLE DISEASES IN MASSACHUSETTS FOR JULY, 1949

Résumé

Disease	July 1949	July 1948	Seven-Year Median
Chancroid	3	4	2*
Chicken pox	490	619	516
Diphtheria	24	14	14
Dog bite	1270	1497	1229
Dysentery, bacillary	1	9	9
German measles	121	61	62
Gonorrhea	257	284	356
Granuloma inguinale	0	0	1*
Lymphogranuloma venereum	0	0	2*
Malaria	1	4	15
Measles	394	2461	1159
Meningitis, meningococcal	5	5	13
Meningitis, Pfeiffer bacillus	2	6	2
Meningitis, pneumococcal	0	3	3
Meningitis, staphylococcal	0	0	0
Meningitis, streptococcal	0	1	0
Meningitis, undetermined	0	3	3
Mumps	442	787	434
Poliomyelitis	93	9	11
Salmonellosis	5	2	11
Scarlet fever	91	269	263
Syphilis	140	225	321
Tuberculosis, pulmonary	259	251	256
Tuberculosis, other forms	12	19	17
Typhoid fever	7	4	4
Undulant fever	4	5	5
Whooping cough	387	130	551

*Five-year median.

Comment

Diseases above the seven-year median were diphtheria, dog bite, German measles, mumps, poliomyelitis, pulmonary tuberculosis and typhoid fever.

Diseases below the seven-year median were chicken pox, bacillary dysentery, malaria, measles, meningococcal meningitis, salmonellosis, scarlet fever, undulant fever and whooping cough.

Diphtheria was still unusually prevalent for this time of year. Although the incidence of German measles and mumps was higher than the seven-year median, both diseases occurred much less often than in the previous month.

The incidence of poliomyelitis reported for the month of July was the highest it has been in the last three decades.

The highest prevalence so far has been in the Boston metropolitan area and toward the north shore.

The incidence of measles was the lowest in forty years. Scarlet fever was at the lowest level ever recorded for July.

GEOGRAPHICAL DISTRIBUTION OF CERTAIN DISEASES

Diphtheria was reported from: Beverly, 1; Boston, 14; Chelsea, 2; Danvers, 1; Leominster, 2; Malden, 3; Medford, 1; total, 24.

Dysentery, bacillary, was reported from: Boston, 1; total, 1.

Encephalitis, infectious, was reported from: Swansea, 1; total, 1.

Infectious hepatitis was reported from: Cambridge, 1; Springfield, 1; Wrentham, 1; total, 3.

Malaria was reported from: Haverhill, 1; total, 1.

Meningitis, meningococcal was reported from: Boston, 1; Easthampton, 1; Salem, 2; Waltham, 1; total, 5.

Meningitis, Pfeiffer bacillus, was reported from: Falmouth, 1; Springfield, 1; total, 2.

Poliomyelitis was reported from: Agawam, 1; Arlington, 2; Beverly, 1; Billerica, 1; Boston, 18; Brockton, 5; Brookline, 1; Cambridge, 7; Chelsea, 2; Dedham, 1; East Longmeadow, 1; Everett, 1; Falmouth, 1; Haverhill, 1; Lynn, 8; Malden, 1; Marlboro, 1; Medford, 2; Melrose, 3; Milton, 1; Natick, 1; Newton, 1; North Attleboro, 2; North Reading, 2; Plymouth, 1; Quincy, 1; Revere, 2; Salem, 1; Salisbury, 1; Saugus, 1; Sharon, 1; Somerville, 6; Springfield, 2; Stoneham, 1; Waltham, 1; Wareham, 1; Watertown, 3; Wellesley, 1; Westwood, 1; Weymouth, 1; Wilmington, 1; Winchester, 1; Worcester, 1; total, 93.

Salmonellosis was reported from: Boston, 3; Plymouth, 1; Waltham, 1; total, 5.

Septic sore throat was reported from: Boston, 4; Lowell, 1; Lynn, 2; total, 7.

Tetanus was reported from: Taunton, 1; total, 1.

Typhoid fever was reported from: Boston, 2; Leominster, 1; Winthrop, 1; Worcester, 3; total, 7.

Undulant fever was reported from: Boston, 1; Douglas, 1; Medway, 1; New Marlboro, 1; total, 4.

MISCELLANY

ANGIOLOGY

Angiology, The Journal of Peripheral Vascular Diseases, will begin publication in February, 1950. Dr. Saul S. Samuels, chief of the Department of Peripheral Arterial Diseases, Stuyvesant Polyclinic, New York City, will be editor-in-chief. Among the associate editors in the United States will be Dr. Alton Ochsner, of Tulane University; Dr. Keith Grimson, of Duke University; Dr. Leo Loewe, of Long Island Medical College; Dr. D. W. Kramer, of Jefferson Medical College; and Dr. Gerald Pratt, of New York University Medical School.

The new journal will be published by the Williams and Wilkins Company, of Baltimore.

CORRESPONDENCE

JARISH-HERXHEIMER REACTION QUESTIONED

To the Editor: There is considerable question in my mind concerning the case report by Dr. Diefenbach in the July 21 issue of the *Journal*, entitled "Fatal Jarish-Herxheimer Reaction with Sudden Aneurysmal Dilatation and Complete Bronchial Occlusion Following Penicillin Therapy." There is no question that the patient died of bronchial obstruction fifty-seven days after the institution of therapy, but whether the penicillin therapy had any causal relation remains unproved, it seems to me. Jarish-Herxheimer reactions usually occur within the first twenty-four to forty-eight hours, and there usually is associated fever, which was absent in this case after the institution of penicillin.

I am a little disappointed to see the *New England Journal of Medicine* publish a report about which, there seems to me, to be so much question.

JAMES H. CURRENS, M.D.

Boston

Dr. Currens's letter was submitted to Dr. Diefenbach who offers the following reply:

Penicillin therapy was instituted late on the first hospital day and x-ray study of the chest showed a clear left-lung field. Thirty-six hours after the administration of penicillin there was sudden dyspnea with all signs of complete obstruction of the left main bronchus, confirmed by bronchoscopy and roentgenogram.

Although it is true that the patient did not expire immediately the fact remains that a Jarish-Herxheimer reaction had occurred and that he subsequently died of a suppurative pneumonia.

WILLIAM C. L. DIEFENBACH, M.D.

Englewood, New Jersey

BOOK REVIEWS

Child Health Services and Pediatric Education. Report of the Committee for the Study of Child Health Services. The American Academy of Pediatrics. With the co-operation of the United States Public Health Service and the United States Children's Bureau. 8°, cloth, 270 pp. New York: The Commonwealth Fund, 1949. $3.50.

The Committee for the Study of Child Health Services of the American Academy of Pediatrics has recently completed a three-year nationwide survey of the services and facilities available for the medical care and health supervision of infants and children. This survey included also a study of the training in pediatrics that the physicians who provided this care had received, both general practitioners and pediatricians, and the opportunities for education in this field now offered by medical schools and hospitals. The book gives the findings of this survey in summary and graphic forms and the Committee's interpretation of these findings. A supplemental report, *Methodology and Tabulations on Services*, also published by the Commonwealth Fund, will be released shortly for those who wish to study the data in greater detail. These two volumes constitute the final report of this national committee and of the survey on a nationwide basis.

This study was initiated by and conducted throughout under the leadership and direction of the American Academy of Pediatrics, its representative, Dr. John P. Hubbard, serving as director. It was carried out with the technical aid and full co-operation of the United States Public Health Service and the United States Children's Bureau. Without the able assistance of Dr. Katherine Bain, of the Children's Bureau, and Mr. Rollo Britten and Mrs. Maryland Pennell, of the United States Public Health Service, this report would not have been possible. The Committee and its large staff were also aided by many national, state and local groups concerned with the care of children, as well as by a large number of practicing physicians, dentists and other persons, who made the required information available. It was accomplished at a cost of $1,000,000 provided collectively by several foundations and commercial houses, as well as by the American Academy of Pediatrics and the National Institute of Health. This is the first time that a comprehensive study of medical services to children has been made in the United States, and it is gratifying that it has been done by the national organization of physicians best qualified to deal with the health problems of children. It is of interest that this organization was able to obtain the very general co-operation of the practicing physicians of the country and that it received at its own request extensive assistance from two governmental agencies equipped through national experience and statistical facilities to meet many of the basic needs for such a project.

Massachusetts physicians have been well represented among the leaders of this project of the Academy at the national level. Dr. Warren Sisson served as chairman of the National Committee, and Dr. John Hubbard, its executive secretary, was in charge of its large staff in Washington. Dr. Lendon Snedeker acted during the survey as regional representative of the central office and now is executive secretary to the Massachusetts Committee, which is preparing the report for this state. Dr. James Wilson is chairman of the Committee for the Improvement of Child Health Services. All of these are now or were formerly Boston pediatricians. The Committee for the Study of Child Health Services now has completed its authorized undertaking, and the Committee for the Improvement of Child Health Services will for-

mulate recommendations designed to correct the deficiencies described in the present report.

This book provides a welcome opportunity to shift the base of discussions of medical needs from broad, undocumented generalizations to sound data applicable to the situations under consideration. Upon such facts alone can a satisfactory program for the improvement of child care be constructed, and the Academy may be justly proud of its leadership in obtaining them. It is unfortunate that comparable information respecting the medical care of other age groups has not been assembled under the leadership of the medical profession so that all discussions of medical care could be approached in the same way.

A unique feature of this report is its excellent condensation and presentation of a large number of data. The charts are expertly constructed to reveal the essential facts; unnecessary tables and statistical compilations have been strictly eliminated. The text is also brief and readable and well correlated with the charts, highlighting them without undue repetition. As a result, the reader is hardly aware of the enormous number of statistical analyses dealt with.

The report is presented in three parts: child health services; pediatric education; and a general summary. In the first part the introductory statements about the technical aspects of the study itself are commendably brief, and the summaries of findings by region, race, density of population, age and economic group begin to occupy the reader's attention in the first chapter. These summaries include data on births, deaths, hospital facilities and amounts of medical, dental and other health services available for each group considered. They show that children in or near cities receive far more medical care, more specialists' services and better hospital and clinic facilities than children living away from cities. They show, furthermore, that community health services do not fill the gaps in medical care for those unable to obtain it privately. For example, 2000 counties in the United States, representing 31 per cent of the children under five years of age, have no well-child conference for those unable to obtain health supervision otherwise. Only 6 per cent of the children in the country as a whole attend such conferences. Health services for school children are found to be almost as inadequate. Variations between the states and their local subdivisions in amounts and kinds of services generally are tremendous.

The second part of the report gives an excellent picture of the extent of training or, more properly, the inadequacies of training in pediatric subjects provided in connection both with undergraduate medical education and with graduate education in hospitals. It shows clearly that present educational facilities do not provide general practitioners the training in child care that they require. Almost half the general practitioners have had little hospital training in pediatrics, and yet three quarters of the private care of children is in their hands.

The character and the extent of the deficiencies in medical care and health services for children throughout the United States and in pediatric education have been clearly revealed by this over-all report. A brief review of the findings in their broad perspective is presented in the third part, which focuses attention on the principal deficiencies. Each of the New England states may determine from this national report its standing among the states and comparable communities in the availability to children of the various services studied and to some extent their quality. The supplementary volume referred to will give more of the crude data for further use by those concerned with development of plans, and the data themselves have been returned to each state and are available to local agencies for further study.

It is not possible in this review to summarize for all types of service the positions held by each New England state in relation to other states or to the national average. The regional summarizations in the report group the New England with the North Central states, and the average ratings for this group of very dissimilar communities are not very informative concerning the situation in any one. The findings for these states are generally favorable in relation to most other regions, and, in some respects, they are outstanding. However, the individual New England states show sharp individual differences as well as local area differences by counties or health districts. Information was made available to Massachusetts on the basis of its public-health districts by special arrangement because the county data were not found satisfactory for use in this state. Individual states in the New England area are to be found in the lowest as well as in the highest categories in some ratings—for example, that for infant mortality. So, also, a high state rating for a given service— for example, the number of physicians available per thousand children— may go hand in hand with the finding that certain communities within the state lack available physicians' services.

Among generally favorable circumstances in the New England states may be mentioned the following: three of these states are in the highest category for number of hospital beds reserved for children. Some of these beds, obviously, are available to children from other states, which, in part because of this, maintain fewer beds for children. The children in all the New England states, except one, have more physicians available and receive more medical care generally and more hospital care specifically than the average for the country as a whole. Children in all these states are also relatively well provided with dental care. All these states exceed the national average in the percentage of births occurring in hospitals, Connecticut having the highest percentage for any state and Massachusetts holding fourth place. On the whole, the record for this region, as revealed by this study, is an excellent one. It offers the best available evidence of the advanced development of medical services in some of the New England states. As in the rest of the country, the local situations that are out of tune with this general picture appear to depend more upon the extent of urbanization of the area than upon state lines. This is particularly true of medical care and is less applicable to health services such as well-child conferences and public-health nursing services, which more clearly reflect state planning. The amount of the physician's time devoted to the various services for well children varies tremendously, being related in part at least to the number of physicians per unit of population.

Physicians will not all agree about the significance to the children concerned of some of the ratings assigned to their communities on the basis of the data obtained in the survey. They will all find it a stimulating undertaking, however, to look at the facts and to attempt to interpret them objectively. No one is better fitted to interpret the facts than the physicians in the community to which the specific ratings apply. The next step obviously is for each state and local community to study its own problems in the light of this revealing information, and all physicians concerned with the care of children will be interested in such an analysis. The progress that is made as a result of this study will depend in no small measure upon the extent to which physicians generally acquaint themselves with the facts, both from the national report and from the studies of local findings. The considered actions that they take individually and collectively to improve local situations will have much to do with the character and effectiveness of this progress.

Each state committee of the Academy is responsible for the report of the findings for its state and for recommendations based upon them. The state chairmen for New England are as follows: Maine, Dr. Thomas A. Foster; New Hampshire, Dr. Colin C. Stewart, Jr.; Vermont, Dr. Paul D. Clark; Massachusetts, Dr. James M. Baty; Rhode Island, Dr. William P. Buffum; and Connecticut, Dr. J. Howard Root. Some state committees have already published reports, but others are still occupied with this large undertaking. The report for Massachusetts is nearing completion and will be available for general distribution early in the fall. Massachusetts is fortunate in having had other studies in progress during the past two or three years that supplement the Academy study and provide a far more adequate body of knowledge than is ordinarily available when a program for improvement of services is being developed.

Conception, Birth and Infancy in Ancient Rome and Modern Italy. By Walter B. McDaniel. 8°, cloth, 77 pp. Lancaster, Pennsylvania: Business Press, Incorporated, 1948.

This monograph, recently given by its author, a distinguished American classical scholar, to the Boston Medical Library, presents the result of his prolonged, painstaking observation and research in the fields of folk medicine and comparative literature. It is a study of the popular beliefs, practices and superstitions relating to conception, pregnancy, childbirth and infancy among the ancient Romans and among their heirs and racial descendants in modern Italy.

Writing as a lover of the Italian land and people, the author has correlated with data from the classics some of the information that he has gathered during years of acquaintance with many parts of the Italian peninsula and of Sicily, and from a lifetime of reading in the voluminous literature in various languages about their inhabitants. But his comparison of two widely separated periods of that people's history is more than "a loving likelihood," for he finds not only that many pagan practices and superstitions persist in combination with Christian custom but also that identical beliefs, charms, drugs, exorcisms, herbs, incantations, spells and talismans that were employed by Romans twenty centuries ago are still used among their peasant descendants of today. Even the Phi Beta Kappa key has been mistaken as some sort of American amulet. Much folk medicine is based on sympathetic magic, on the familiar principle of *similia similibus curantur*.

This volume, which is abundantly documented by a bibliography of 350 references to classical and modern literature, is an invaluable treasury of interest to gynecologists, obstetricians and pediatricians, as well as to students of the classics and of folklore and folkways. It is a humanistic work of well directed research and of profound scholarship.

BOOKS RECEIVED

The receipt of the following books is acknowledged, and this listing must be regarded as a sufficient return for the courtesy of the sender. Books that appear to be of particular interest will be reviewed as space permits. Additional information in regard to all listed books will be gladly furnished on request.

Which Way Out: Stories based on the experience of a psychiatrist. By C. P. Oberndorf, M.D. 8°, cloth, 236 pp. New York: International Universities Press, Incorporated, 1948. $3.25.

In this volume the author presents eleven fictional stories, with the object of portraying different psychopathic personalities. None of the stories are depictions of true experiences. The publishing is well done in every way.

A Synopsis of Physiology. By A. Rendle Short, B.Sc., M.D., F.R.C.S., C. L. G. Pratt, O.B.E., M.A., M.D., M.Sc., lecturer in mammalian physiology, University of Cambridge, and fellow of Christ's College, Cambridge, and C. C. N. Vass, M.Sc., Ph.D., M.B., Ch.B., reader in physiology in the University of London. Fourth edition. 12°, cloth, 346 pp., with 23 illustrations. Baltimore: Williams and Wilkins Company, 1948. $6.00.

The authors have completely revised and completely rewritten some sections to bring the manual up to date since the publication of the third edition in 1938. The object of the book is to give a fairly full summary of modern physiology, especially human, in a small space. For beginners the synopsis should be used in conjunction with textbooks on physiology, including biochemistry and experimental physiology, and histology. The text was printed in Great Britain. The number of editions speaks well for the soundness of the book.

Recent Advances in Respiratory Tuberculosis. By Frederick Heaf, M.A., M.D., F.R.C.P., senior medical officer, London County Council, honorary medical director, British Legion Village, Preston Hall, Kent, and consulting physician, Papworth Village Settlement; and N. Lloyd Rusby, M.A., D.M., F.R.C.P., assistant physician, the London Hospital, physician, the London Chest Hospital, and consulting physician to the British Legion Sanatorium, Preston Hall, and the National Sanatorium, Benenden. Fourth edition. 12°, cloth, 290 pp., with 5 plates and 7 text-figures. Philadelphia: Blakiston Company, 1948. $5.50.

The authors in this fourth edition, first published in 1929 and later in 1931 and 1937, by the late Dr. L. S. T. Burrell, have brought the material up to date. They believe that the environmental and social aspects of tuberculosis have become very important during the last decade, and for the first time have included chapters on these aspects. The material on public-health services, including legislation, is based on British practice. Considerable space is devoted to artificial pneumothorax and collapse therapy. A list of selected references is appended to each subject. The text was printed in Great Britain, and the volume is well published. It should prove useful as a reference source.

Essentials of Gynecologic Endocrinology (with Sections on the Male). By Gardner M. Riley, Ph.D., assistant professor of obstetrics and gynecology. University of Michigan Medical School. 8°, paper, 205 pp., with 31 illustrations. Ann Arbor, Michigan: Caduceus Press, 1948. $3.00.

The author, in this manual, presents the fundamentals of reproductive physiology, the endocrine aspects of gynecologic dysfunction and details of useful procedures. The material is based in a large part upon the lectures and discussions prepared for the Gynecology Endocrine Conferences of the Department of Obstetrics and Gynecology of the University of Michigan Medical School. The book is designed for medical students, interns and physicians who have to deal with gonadal function in the male or female. The text is divided into three parts: endocrine physiology; clinical material; and diagnostic procedures, sex-hormone chemistry and endocrine preparations. There is a special chapter on the endocrinology of the male. The material is well organized. A list of selected references is appended to each chapter. There is a good index, and the volume is well published by the offset process. The book should prove useful as a compend in the subject.

Common Skin Diseases. By A. C. Roxburgh, M.A., M.D., B. Ch. Cantab., F.R.C.P., consulting physician and lecturer, St. John's Hospital for Diseases of the Skin, and dermatologist to the Royal Masonic Hospital. Eighth edition. 8°, cloth, 497 pp., with 212 illustrations. Philadelphia: Blakiston Company, 1948. $7.00. *General Practice Series.*

This textbook, a part of the *General Practice Series*, has an interesting history, speaking well for its soundness. It was first published in 1932, and since then has appeared in eight editions and seven reprints, making a total of fifteen issues. In addition the eighth edition was translated into French in 1948. The book which is intended for the general practitioner, discusses the important phases of diagnosis and treatment, with special emphasis on differential diagnosis. This last edition has added the use of penicillin and D.D.T. in dermatology. The text has been revised and brought up to date, the latest knowledge on various skin diseases being incorporated. Whatever references are used are interspersed throughout the text. There is a good index. The text was printed in Great Britain with a good type on good paper. A heavy paper was necessary for the illustrations, and it is evident that a sufficient supply was found for this edition. The binding is well done. It is interesting to note that the Blakiston Company has entered the business of importing the pages of a book, and binding and distributing in the United States. Although reflecting the British point of view, the book should be in all medical libraries and prove useful to the general practitioner.

Anesthesia: Principles and Practice. A presentation for the nursing profession. By Alice M. Hunt, R.N. 12°, cloth, 148 pp. New York: G. P. Putnam's Sons, 1949. $2.60.

This manual is written for nurses, and Miss Hunt places the emphasis on the patient and not on the surgeon and writes accordingly. She is well qualified in her subject, since she was attached for twenty-five years to the Yale University School of Medicine and the New Haven Hospital. A graduate of the School of Nursing of the Union Hospital at Fall River, she began the study of anesthesia at the Truesdale Hospital in the same city, where she became head of the nursing service. She later became head of the service at the Peter Bent Brigham Hospital in Boston, from where she went to the New Haven Hospital as chief of the service. She became a member of the faculty of Yale University School of Medicine and was retired on July 1, 1948, with the rank of associate professor of anesthesia, emeritus. After a short historical chapter, the book discusses the physiology and general methods, followed by the different anesthetics and the special methods of anesthesia. There is a selected bibliography and a good index. The manual is well published and should prove useful, not only to nurses but also to physicians.

How To Live Longer. By Justus J. Schifferes. With a foreword by Ralph F. Sikes, M.D. 8°, cloth, 255 pp. New York: E. P. Dutton and Company, Incorporated, 1949. $3.00.

Mr. Schifferes, formerly a teacher of health education and hygiene at Columbia University and Teachers College, organizer and director of the Health Education Council, co-founder of the periodical *Modern Medicine* and its editor for ten years, has written a popular manual on the prevention of the great common diseases of mankind. The volume is not a "home medical handbook"; it does not diagnose illnesses or prescribe treatment. It endeavors to point out the warning signs in time for proper therapy to be instituted. The text is written in simple, nontechnical language and is based on the latest information on public health and on the latest United States Government statistics. It discusses the "Big Killers"—heart disease, cancer, stroke, kidney disease, accidents, pneumonia, tuberculosis, premature birth, diabetes, suicide and syphilis. The chapter entitled "Little Danger Signals" is very valuable and should be available to the entire population of the country. The final chapter comprises a list of health-promoting organizations and their publications. There is a good index. The type, printing and paper are excellent for this type of book, which should be in all public libraries and in the popular section of medical libraries.

Your Coughs, Colds and Wheezes. By Joseph D. Wassersug, M.D. 12°, cloth, 277 pp. New York: Wilfred Funk, Incorporated, 1949. $2.95.

In this book for the laity the author discusses the common cold, its prevention and treatment and the various respiratory diseases. Dr. Wassersug is a competent authority on chest diseases and enjoys a wide experience in that field. The text is well written but seems a little too technical in certain places for the general reader.

NOTICES

ANNOUNCEMENT

Dr. S. Brodie announces the opening of his office for the practice of pediatrics at 238 North Main Street, Fall River, Massachusetts.

94TH INFANTRY DIVISION LECTURES

The 94th (Bay State) Infantry Division is sponsoring a series of monthly lectures by prominent physicians in their respective specialties. The sixth lecture will be held in the auditorium of Boston University School of Medicine, 80 East Concord Street, Boston, on Wednesday, September 28, at 8 p.m.

Dr. William L. Fleming will speak on the subject "Present Status of Penicillin Therapy in Syphilis."

All interested physicians, whether reserve officers or not, are cordially invited to attend this carefully planned program. Reserve officers will be given one point credit if authorized by the instructor of their unit of assignment. Excellent films will also be shown during this period.

SOCIETY MEETINGS AND CONFERENCES

SEPTEMBER 13. New England Society of Anesthesiologists. Page 350, issue of September 1.

SEPTEMBER 28. New England Pediatric Society. Page 136, issue of July 21.

SEPTEMBER 28. 94th Infantry Division Lecture. Notice above.

SEPTEMBER 28-30. Mississippi Valley Medical Society. Page xi, issue of July 14.

OCTOBER 3–MAY 19. Massachusetts Department of Mental Health. Postgraduate Seminar in Neurology and Psychiatry. Page 286, issue of August 18.

OCTOBER 11-15. American Society of Clinical Pathologists. Drake Hotel, Chicago.

OCTOBER 13. Mononucleosis. Dr. Andrew Contratto. Pentucket Association of Physicians. 8:30 p.m. Haverhill.

OCTOBER 24-26. National Gastroenterological Association. Page 251, issue of August 11.

OCTOBER 24-28. American Public Health Association. Page 251, issue of August 11.

NOVEMBER 2. New England Obstetrical and Gynecological Society. Hotel Somerset, Boston.

NOVEMBER 2-5. Pan-American Congress of Pediatrics. Page 251, issue of August 11.

NOVEMBER 3-5. American Association of Blood Banks. Page xi, issue of June 16.

NOVEMBER 7-9. National Society for Crippled Children and Adults. Page 184, issue of July 28.

NOVEMBER 7-12. International College of Surgeons. Page 251, issue of August 11.

NOVEMBER 14-17. American Academy of Pediatrics. Page 251, issue of August 11.

NOVEMBER 16. Massachusetts State Society of Examining Physicians. Page 324, issue of August 25.

DECEMBER 28 AND 29. American Association for the Advancement of Science. Page 350, issue of September 1.

FEBRUARY 20-23. American Academy of General Practice. Page 252, issue of August 11.

JULY 17-22. International Congress for Scientific Research. Page xvii, issue of September 1.

CALENDAR OF BOSTON DISTRICT FOR THE WEEK BEGINNING THURSDAY, SEPTEMBER 15

FRIDAY, SEPTEMBER 16

*9:00 a.m.–12:00 m. Combined Medical and Surgical Staff Rounds. Peter Bent Brigham Hospital.

*12:00 m. X-Ray Conference. Margaret Jewett Hall, Mount Auburn Hospital, Cambridge.

*1:30 p.m. Tumor Clinic. Out-Patient Department, Mount Auburn Hospital, Cambridge.

MONDAY, SEPTEMBER 19

*11:30 a.m.–12:15 p.m. Chest X-Ray Conference. South End Health Unit, 57 East Concord Street, Boston. Dr. Cleaveland Floyd in charge.

*12:15–1:15 p.m. Clinicopathological Conference. Main Amphitheater, Peter Bent Brigham Hospital.

TUESDAY, SEPTEMBER 20

*12:15–1:15 p.m. Clinicoroentgenological Conference. Peter Bent Brigham Hospital.

*1:30–2:30 p.m. Pediatric Rounds. Burnham Memorial Hospital for Children, Massachusetts General Hospital.

WEDNESDAY, SEPTEMBER 21

*12:00 m.–1:00 p.m. Clinical Conference. (Children's Hospital.) Amphitheater, Peter Bent Brigham Hospital.

*Open to the medical profession.

Dr. Wise, soundly trained and well read,
To a fellow practitioner said
Here's a word from the Wise—
Better firms advertise
***In the* New England Journal of Med.**

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